PRIRODOSLOVNO-MATEMATIČKI FAKULTET U SPLITU

Erasmus catalogue
2023./2024.

	ID	Subject name	Subject name (EN)	Hours (Lectures+Seminars+ Exercises+Fieldwork)	ECTS	Semester	Level	Study
1.	PMT201 251420	3D printanje	3D printing	30+0+30+0	6	5 3 1	Undergraduate Graduate	Computer Science; Physics (specialization in Computational Physics); Computer Science and Technics, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education
2.	PMM602 245248	Algebra I	Algebra I	45+0+0+0	6	1	Graduate	Mathematics (specialization in Pure Mathematics)
3.	PMM606 245252	Algebra II	Algebra II	45+0+0+0	6	2	Graduate	Mathematics (specialization in Pure Mathematics)
4.	PMC223 240180	Analitičke metode	Analytical methods	30+15+30+0	4	4	Undergraduate	Biology
5.	PMM502 227875	Analiza kompleksnih mreža	Complex networks analysis	30+0+30+0	5	4 2	Graduate	Mathematics (specialization in Computer Science); Mathematics (specialization in Pure Mathematics); Mathematics (specialization in Statistics and Computer Science)
6.	PMP272 186528	Analiza podataka u fizici visokih energija	Data Analysis in High Energy Physics	30+0+30+0	6	3	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Computational Physics)
								Data science and engineering; Computer Science, specialization

								in Education;
7.	PMII15 211924	Arhitekture neuronskih mreža	Neural Network Architectures	30+0+30+0	5	3	Graduate	Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Computer Science); Mathematics (specialization in Statistics and Computer Science)
8.	PMP133 186531	Astročestična fizika	Astroparticle Physics	30+0+15+0	5	3	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Computational Physics)
9.	PMP131 201868	Astrofizika I	Astrophysics I	30+0+30+0	6	1	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics)
10.	PMP230 201870	Astrofizika II	Astrophysics II	30+0+30+0	6	2	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics)
11.	PMB025 173061	Beskralježnjaci	Beskralježnjaci	30+0+45+0	6.5	4	Undergraduate	Biology and Chemistry; Biology
12.	PMP141 186397	Biofizika	Biophysics	30+15+15+0	6	3 1	Graduate	Physics (specialization in Computational Physics); Physics (specialization in Education); Physics (specialization in Biophysics); Physics and Computer Science, specialization in Education
13.	PMP213 202054	Biofizika bioloških membrana	Biophysics of Biological Membranes	30+5+25+0	6	2	Graduate	Physics (specialization in Biophysics)
14.	PMP247 173810	Biofizika slušanja i govora	Biophysics of Hearing and Speech	35+5+10+0	6	2	Graduate	Physics (specialization in Biophysics)
								Mathematics and Physics,

								specialization in Education;
15.	PMP140 99956	Bioinformatika	Bioinformatics	30+0+30+0	6	3 1	Graduate	Physics (specialization in Biophysics); Physics and Computer Science, specialization in Education
16.	PPC211 79373	Bioinformatika	Bioinformatics	15+0+15+0	2	5 1	Undergraduate Graduate	Biology and Chemistry; Biology and Chemistry, specialization in Education
17.	PMC103 61086	Biokemija I	Biochemistry I	30+15+0+0	6.5	5 1	Undergraduate Graduate	Biology; Biology and Chemistry; Physics; Physics (specialization in Biophysics)
18.	PMC106 61093	Biokemija II	Biochemistry II	30+15+0+0	6.5	6 2	Undergraduate Graduate	Biology and Chemistry; Physics; Physics (specialization in Biophysics)
19.	PMC225 228204	Biokemija II	Biochemistry II	30+15+45+0	6.5	6	Undergraduate	Biology
20.	PMB519 228192	Biološka evolucija	Biological Evolution	30+15+0+0	3	5	Undergraduate	Biology
21.	PMB513 212276	Biološka oceanografija	Biološka oceanografija	30+15+0+0	4	4	Undergraduate	Biology
22.	PMB540 251445	Biološka raznolikost	Biološka raznolikost	15+15+0+0	2	5	Undergraduate	Biology
23.	PMC206 148094	Biotehnologija	Biotechnology	15+0+15+0	2.5	4	Graduate	Biology and Chemistry, specialization in Education
24.	PPB253 173081	Citogenetičke analize kromosoma	Citogenetičke analize kromosoma	10+5+15+0	2	5	Undergraduate	Biology; Biology and Chemistry
25.	PMP235 251501	Detektori u fizici visokih energija	Detectors in High Energy Physics	30+0+0+0	3	1	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics)
								Biology and Chemistry, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education; Computer

26.	PMS105 79107	Didaktika	Didactics	30+15+0+0	3	1	Graduate	Science, specialization in Education; Computer Science and Technics, specialization in Education; Mathematics (specialization in Education); Mathematics and Physics, specialization in Education; Mathematics and Computer Science, specialization in Education
27.	PMM950 159820	Diferencijalne jednadžbe	Differential equations	30+0+30+0	6	3	Undergraduate	Physics; Mathematics and Physics (specialization in Education); Mathematics and Physics (Inženjerski); Mathematics and Physics
28.	PMM152 240159	Diferencijalni i integralni račun I	Differential and Integral Calculus I	45+0+60+0	8.5	2	Undergraduate	Mathematics; Mathematics and Physics; Mathematics and Computer Science, specialization in Education
29.	PMM156 240160	Diferencijalni i integralni račun II	DIFFERENTIAL AND INTEGRAL CALCULUS II	45+0+60+0	9	5 3	Undergraduate	Mathematics and Physics; Mathematics and Computer Science, specialization in Education; Mathematics and Physics (specialization in Education)
30.	PMP267 216066	Dinamički sustavi u okolišu	Dynamical Systems in the Environment	30+20+0+0	4	2	Graduate	Physics (specialization in Environmental Physics)
31.	PMP270 186480	Dinamika atoma u plinovima i tekućinama	Dynamics of Atoms in Gases and Liquids	30+15+15+0	5	3 1	Graduate	Physics (specialization in Biophysics); Physics (specialization in Computational Physics)
								Physics

32.	PMPMSC 68256	Diplomski rad	Diploma Thesis	0+10+0+0	30	4	Graduate	(specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics)
33.	PMPMSC 79688	Diplomski rad	Diploma Thesis	0+10+0+0	18	4	Graduate	Physics (specialization in Education)
34.	PMPMSC 201573	Diplomski rad	Diploma Thesis	0+30+0+0	12	4	Graduate	Mathematics and Physics, specialization in Education; Physics and Computer Science, specialization in Education
35.	PPB265 79365	Ekologija podzemnih staništa	Ekologija podzemnih staništa	15+15+0+0	2	6 2	Undergraduate Graduate	Biology and Chemistry; Biology and Chemistry, specialization in Education
36.	PMP122 173564	Eksperimentalne metode moderne fizike	Experimental Methods of Modern Physics	30+15+0+0	4	1	Graduate	Engineering Physics (specialization in Mechanical Systems); Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Computational Physics); Physics and Computer Science, specialization in Education
								Physics

37.	PMP264 216062	Ekstremne pojave u okolišu	Extreme Environmental Phenomena	30+0+15+0	4	3	Graduate	(specialization in Environmental Physics)
38.	PMP003 251428	Elektricitet i magnetizam	Electricity and Magnetism	60+15+30+0	9	4 2	Undergraduate	Mathematics (specialization in Applied Mathematics); Physics; Mathematics and Physics
39.	PMP118 201707	Elektrodinamika	Electrodynamics	45+15+30+0	8	5	Undergraduate	Mathematics and Physics; Mathematics (specialization in Applied Mathematics); Mathematics and Physics (specialization in Education); Mathematics and Physics (Inženjerski)
40.	PMM019 111939	Elementarna geometrija	Elementary geometry	30+0+30+0	6	2 4 6	Undergraduate	Mathematics (staro); Mathematics and Computer Science (staro); Mathematics and Physics (specialization in Education); Mathematics and Physics (Inženjerski); Mathematics; Mathematics and Computer Science, specialization in Education; Mathematics and Physics
41.	PMT168 79744	Energetika	Energetics	30+15+0+0	4	1	Graduate	Computer Science and Technics, specialization in Education
42.	PMT175 87307	Energetika i okoliš	Energy and environment	15+15+0+0	2	3	Graduate	Computer Science and Technics, specialization in Education
43.	PMB241 186378	Evolucija	Evolucija	30+0+0+0	2.5	3	Graduate	Biology and Chemistry, specialization in Education
								Mathematics and Physics, specialization in Education; Mathematics and Computer

44.	PMM306 67174	Financijska matematika	Financial mathematics	30+0+30+0	5	3 1	Graduate	Science, specialization in Education; Mathematics (specialization in Computer Science); Mathematics (specialization in Education); Mathematics (specialization in Statistics and Computer Science)
45.	PMP201 186404	Fizika čvrstog stanja	Solid State Physics	30+0+30+0	6	1 3	Graduate	Engineering Physics (specialization in Thermodynamic Systems); Engineering Physics (specialization in Mechanical Systems); Mathematics and Physics, specialization in Education; Physics (specialization in Biophysics); Physics (specialization in Environmental Physics); Physics and Computer Science, specialization in Education; Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Computational Physics)
	PMP20E	Fizika	Elementary			4		Mathematics and Physics, specialization in Education; Physics (specialization in Education); Physics (specialization

46.	227862	elementarnih čestica I	Particle Physics I	45+0+15+0	6	2	Graduate	in Astrophysics and Elementary Particle Physics); Physics (specialization in Computational Physics)
47.	PMP234 240175	Fizika elementarnih čestica II	Elementary Particle Physics II	45+0+15+0	6	3	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Computational Physics)
48.	PMP163 216059	Fizika mora I	Ocean Physics I	30+0+15+0	5	3 1	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Education); Physics (specialization in Environmental Physics)
49.	PMP268 240173	Fizika mora II	Ocean Physics II	30+5+15+0	5	4 2	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Environmental Physics)
50.	PMP273 148196	Fizika plazme i fuzijska tehnologija	Plasma Physics and Fusion Technology	45+0+30+0	6	1 3	Graduate	Engineering Physics (specialization in Mechanical Systems); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics)
51.	PMB034 133763	Fiziologija bilja	Plant physiology	45+0+45+0	8	5	Undergraduate	Biology; Biology and

								Chemistry
52.	PMM820 215449	Fourierova analiza i primjene	Fourier Analysis and Applications	30+0+30+0	5	5 3 4	Undergraduate Graduate	Mathematics (specialization in Applied Mathematics); Mathematics (specialization in Pure Mathematics)
53.	PMB547 212274	Genetika i biotehnologija u agrikulturi	Genetika i biotehnologija u agrikulturi	30+10+20+0	4	3	Undergraduate	Biology
54.	PMB020 133977	Histologija	Histologija	30+0+30+0	5	3	Undergraduate	Biology and Chemistry
55.	PMIH30 172995	Interakcija čovjeka i računala: osnove i principi	Human Computer Interaction:: Fundamentals and Principles	30+0+30+0	5	4 2	Undergraduate Graduate	Computer Science; Physics and Computer Science, specialization in Education; Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Computer Science); Computer Science and Technics, specialization in Education
56.	PMP134 227870	Istraživački rad	Research Project	0+30+0+0	5	3	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics)
57.	PMP276 99735	Istraživački rad iz računarske fizike I	Research in Computational Physics I	0+20+0+0	5	2	Graduate	Physics (specialization in Computational Physics)
58.	PMP407 186484	Istraživački rad iz biofizike	Research in Biophysics	10+20+0+0	5	3	Graduate	Physics (specialization in Biophysics)
59.	PMP26C 227855	Istraživački rad iz fizike okoliša	Research in Environmental Physics	10+20+30+0	6	3	Graduate	Physics (specialization in Environmental Physics)
60.	PMP277 186530	Istraživački rad iz računarske fizike II	Research in Computational Physics II	5+15+0+0	5	3	Graduate	Physics (specialization in Computational Physics)
61.	PMC311 134007	Istraživanja u kemijskom obrazovanju	Chemistry Education Research	15+15+0+0	2	3	Graduate	Biology and Chemistry, specialization in Education

62.	PPC310 79378	Izolacija fitonutrijenata	Izolacija fitonutrijenata	15+0+15+0	2	5 1	Undergraduate Graduate	Biology and Chemistry; Biology and Chemistry, specialization in Education
63.	PMS173 79233	Izvannastavne i izvanškolske aktivnosti	Extracurricular Activities	15+15+0+0	2	4 2	Graduate	Biology and Chemistry, specialization in Education; Computer Science, specialization in Education; Mathematics and Physics, specialization in Education; Physics (specialization in Education); Computer Science and Technics, specialization in Education; Mathematics (specialization in Education)
64.	PMS104 60522	Jezična kultura	Language Culture	15+15+0+0	2	6 4 2	Undergraduate	Computer Science; Mathematics (specialization in Mathematics); Mathematics (staro); Computer Science and Technics
65.	PPC311 133989	Kemija ugljikohidrata u prehrani	Kemija ugljikohidrata u prehrani	30+0+0+0	2	6	Undergraduate	Biology and Chemistry
66.	PMS135 79108	Kineziološka aktivnost, fitness i zdravlje	Kinesiological activity, fitness and health	15+0+15+0	2	3 1	Graduate	Biology and Chemistry, specialization in Education; Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Environmental Physics); Physics

								(specialization in Computational Physics); Mathematics (specialization in Education); Mathematics and Physics, specialization in Education
67.	PMP116 186642	Klasična mehanika	Clasical Mechanics	45+0+45+0	8	5 3	Undergraduate	Mathematics (specialization in Applied Mathematics); Mathematics and Physics (specialization in Education); Mathematics and Physics (Inženjerski); Mathematics and Physics
68.	PMP110 251437	Klasična mehanika I	Classical Mechanics I	45+0+30+0	6	3	Undergraduate	Physics
69.	PMP111 251441	Klasična mehanika II	Classical Mechanics II	45+0+30+0	6	4	Undergraduate	Physics
70.	PMP112 251447	Klasični elektromagnetizam	Classical Electromagnetism	45+15+30+0	6	5	Undergraduate	Physics
71.	PMP169 227866	Klimatski sustav	Climate System	35+0+30+0	6	3	Graduate	Physics (specialization in Environmental Physics)
72.	PMS174 159956	Kognitivna psihologija	Kognitivna psihologija	15+15+15+0	4	4	Graduate	Mathematics (specialization in Education)
73.	PMM804 186594	Kombinatorika	Combinatorics	30+0+30+0	5	4 6	Undergraduate	Mathematics (staro); Mathematics and Computer Science (staro); Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (specialization in Applied Mathematics); Mathematics and Physics (specialization

								in Education); Mathematics and Physics (Inženjerski); Mathematics and Physics
74.	PMM116 60987	Kompleksna analiza	Complex analysis	30+0+30+0	6	5 6	Undergraduate	Mathematics and Physics; Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (specialization in Applied Mathematics); Mathematics (staro); Mathematics and Computer Science (staro); Mathematics and Physics (specialization in Education)
75.	PMSN09 134030	Komunikacijske vještine	Communication Skills	15+15+0+0	2	6 4	Undergraduate Graduate	Computer Science; Biology and Chemistry, specialization in Education; Mathematics (specialization in Education); Computer Science and Technics, specialization in Education
76.	PMB525 251440	Konzervacijska biologija	Conservation biology	30+15+0+0	3	6	Undergraduate	Biology
77.	PMB525 227854	Konzervacijska biologija	Konzervacijska biologija	30+15+0+0	4	6	Undergraduate	Biology
78.	PMB517 227846	Kralježnjaci	Vertebrates	30+15+30+0	6.5	5	Undergraduate	Biology
79.	PMB031 227845	Kralježnjaci	Kralježnjaci	30+15+30+0	6.5	5	Undergraduate	Biology and Chemistry
								Mathematics (specialization in Pure Mathematics); Mathematics (specialization in Education);

80.	PMM205 79334	Kriptografija	Cryptography	30+15+15+0	5	3 1	Graduate	Mathematics (specialization in Statistics and Computer Science); Mathematics (specialization in Computer Science)
81.	PMP117 251451	Kvantna fizika	Quantum Physics	40+15+30+0	6	6	Undergraduate	Physics; Mathematics and Physics
82.	PMP202 251497	Kvantno računanje	Quantum Computing	30+15+15+0	6	3 1	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Education); Physics (specialization in Computational Physics); Physics and Computer Science, specialization in Education
83.	PMM153 240155	Linearna algebra I	Linear Algebra I	45+0+60+0	8.5	1	Undergraduate	Mathematics; Mathematics and Physics; Mathematics and Computer Science, specialization in Education
84.	PMM154 240156	Linearna algebra II	Linear algebra II	45+0+60+0	8.5	2	Undergraduate	Mathematics; Mathematics and Physics; Mathematics and Computer Science, specialization in Education
85.	PPB266 79366	Makrozoobentos krških tekućica	Makrozoobentos krških tekućica	15+15+0+0	2	5	Undergraduate	Biology; Biology and Chemistry
86.	PMM157 240189	Matematička analiza u R^n I	Mathematical analysis in R^n I	45+0+45+0	7.5	3	Undergraduate	Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (specialization in Applied Mathematics); Mathematics and Physics (Inženjerski); Mathematics

								and Physics
87.	PMM158 240154	Matematička analiza u R^n II	Mathematical analysis in Rn II	45+0+60+0	7.5	4	Undergraduate	Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (specialization in Applied Mathematics); Mathematics and Physics (Inženjerski); Mathematics and Physics
88.	PMM110 67177	Matematička logika	Mathematical Logic	30+0+30+0	5	3	Undergraduate	Mathematics (staro); Mathematics and Computer Science (staro); Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science)
89.	PMM612 245244	Matematička teorija računarstva	Mathematical theory of Computation	45+0+30+0	6	4 3 2 1	Graduate	Mathematics (specialization in Pure Mathematics); Mathematics (specialization in Education); Mathematics (specialization in Computer Science); Mathematics (specialization in Statistics and Computer Science)
90.	PMP107 251439	Matematičke metode fizike I	Mathematical methods of physics I	45+15+30+0	6	3	Undergraduate	Physics
91.	PMP101 87742	Matematičke metode fizike II	Mathematical Methods of Physics II	45+0+30+0	6	4	Undergraduate	Physics
92.	PMP102 79383	Matematičke metode fizike III	Mathematical Methods of Physics III	30+0+30+0	5	5	Undergraduate	Physics
93.	PMM017 240162	Matematički programski alati I	Matematički programski alati I	0+0+30+0	2	3	Undergraduate	Mathematics (specialization in Computer Science)
								Mathematics (staro); Mathematics

94.	PMM018 147957	Matematički programski alati II	athematical program tools II	0+0+30+0	2	2 6	Undergraduate	and Computer Science (staro); Mathematics and Physics (Inženjerski)
95.	PMM018 240188	Matematički programski alati II	Mathematical program tools II	0+0+30+0	2	6	Undergraduate	Mathematics (specialization in Mathematics)
96.	PMT154 79737	Materijali	Materials	45+0+15+0	5	3	Undergraduate	Computer Science and Technics
97.	PMP001 251426	Mehanika	Mechanics	60+15+30+0	9	3 1	Undergraduate	Mathematics (specialization in Applied Mathematics); Physics; Mathematics and Physics
98.	PMP161 240172	Meteorologija I	Meteorology I	30+5+15+0	5	3 1	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Education); Physics (specialization in Environmental Physics)
99.	PMP260 216065	Meteorologija II	Meteorology II	30+0+15+0	5	2	Graduate	Physics (specialization in Environmental Physics)
100.	PMC216 186381	Metodička praksa nastave kemije sa seminarom I	Chemistry Education Practice and Seminar I	0+15+30+0	2.5	3	Graduate	Biology and Chemistry, specialization in Education
101.	PMC215 186383	Metodička praksa nastave kemije sa seminarom II	Chemistry Education Practice and Seminar II	0+15+30+0	3	4	Graduate	Biology and Chemistry, specialization in Education
102.	PMP250 79687	Metodika nastave fizike III	Physics Education III	30+30+30+0	6	4	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Education)
103.	PMC210 79847	Metodika nastave kemije I	Chemistry Education I	30+30+0+0	4	2	Graduate	Biology and Chemistry, specialization in Education
104.	PMC212 134000	Metodika nastave kemije II	Chemistry Education II	30+30+0+0	5	3	Graduate	Biology and Chemistry, specialization in Education
								Mathematics and Physics, specialization in Education;

105.	PMM133 97073	Metodika nastave primijenjene matematike	MMethods of Instructions in Applied Mathematics	30+0+30+0	5	4 2	Graduate	Mathematics (specialization in Education); Mathematics and Computer Science, specialization in Education
106.	PMIH40 173002	Metodologija dizajna interakcija	Interaction Design Methodology	30+0+30+0	5	5 1	Undergraduate Graduate	Computer Science; Computer Science, specialization in Education
107.	PMS114 79116	Metodologija istraživanja u obrazovanju	Research Methodology in Education	30+15+0+0	3	3 1	Graduate	Computer Science, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education; Mathematics (specialization in Education); Computer Science and Technics, specialization in Education; Mathematics and Physics, specialization in Education
108.	PMS114 67180	Metodologija istraživanja u obrazovanju	Metodologija istraživanja u obrazovanju	15+15+0+0	2	4	Graduate	Biology and Chemistry, specialization in Education
109.	PMP104 99958	Metodologija istraživanja u prirodnim znanostima	Research Methodology in Natural Sciences	30+0+15+0	4	2	Graduate	Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics)

110.	PMM601 245249	Metrički prostori	Metric spaces	45+0+0+0	6	1	Graduate	Mathematics (specialization in Pure Mathematics)
111.	PMB413 173084	Mikroorganizmi oko nas	Mikroorganizmi oko nas	15+0+15+0	2	5	Undergraduate	Biology and Chemistry
112.	PMP26E 227849	Modeliranje elektromagnetskih pojava u okolišu	Modelling Electromagnetic Phenomena in the Environment	30+20+10+0	6	3	Graduate	Physics (specialization in Environmental Physics)
113.	PMP26D 227852	Modeliranje fluida u okolišu	Environmental Fluid Dynamics	30+20+10+0	6	3	Graduate	Physics (specialization in Environmental Physics)
114.	PMP249 227869	Modeliranje i simulacije biomakromolekula	Modelling and Simulations of Biomacromolecule	30+0+30+0	5	3	Graduate	Physics (specialization in Biophysics)
115.	PMP008 251444	Moderna fizika	Modern Physics	45+15+30+0	6	4	Undergraduate	Physics; Mathematics and Physics
116.	PMB545 212278	Molekularna genetika	Molekularna genetika	30+15+0+0	3.5	4	Undergraduate	Biology
117.	PMIH50 173006	Multimodalna interakcija i sučelja	Multimodal Interaction and Iinterfaces	30+0+30+0	5	6 2	Undergraduate Graduate	Computer Science; Computer Science, specialization in Education
118.	PMP113 251450	Napredna elektrodinamika	Advanced Electrodynamics	45+15+30+0	6	6	Undergraduate	Physics
119.	PMP200 251483	Napredna kvantna fizika	Advanced Quantum Physics	30+15+30+0	6	1	Graduate	Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics); Physics and Computer Science, specialization in Education; Mathematics and Physics, specialization in Education

120.	PMS201 79675	Napredni modeli nastave	Advanced models of teaching	15+15+0+0	2	3 4	Graduate	Computer Science, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education; Mathematics (specialization in Education); Computer Science and Technics, specialization in Education
121.	PMS176 216041	Nasilje među djecom	Nasilje među djecom	15+15+0+0	2	4	Graduate	Biology and Chemistry, specialization in Education; Mathematics (specialization in Education)
122.	PMM605 245253	Normirani prostori	Normed spaces	45+0+0+0	6	2	Graduate	Mathematics (specialization in Pure Mathematics)
123.	PMP203 201847	Nuklearna fizika	Nuclear Physics	30+0+30+0	5	2 4	Graduate	Engineering Physics (specialization in Thermodynamic Systems); Engineering Physics (specialization in Mechanical Systems); Mathematics and Physics, specialization in Education; Physics and Computer Science, specialization in Education; Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics

								(specialization in Environmental Physics); Physics (specialization in Computational Physics)
124.	PMM118 79583	Numerička analiza	Numerical analysis	30+0+30+0	5	4 2	Graduate	Mathematics (specialization in Computer Science); Mathematics (specialization in Pure Mathematics); Mathematics (specialization in Statistics and Computer Science)
125.	PMM210 68172	Numerička linearna algebra	Numerička linearna algebra	30+0+30+0	5	2	Graduate	Mathematics (specialization in Computer Science); Mathematics (specialization in Statistics and Computer Science)
126.	PMP263 202056	Numeričko modeliranje vremena i klime	Numerical Modelling of Weather and Climate	30+0+20+0	5	3	Graduate	Physics (specialization in Environmental Physics)
127.	PMM103 60972	Obične diferencijalne jednadžbe	Ordinary differential equations	30+0+30+0	6	5 3	Undergraduate	Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (specialization in Applied Mathematics); Mathematics (staro); Mathematics and Computer Science (staro)
								Physics; Engineering Physics (specialization in Thermodynamic Systems); Engineering Physics (specialization in Mechanical

128.	PMID30 79284	Objektno orijentirano programiranje	Object oriented programming	30+0+30+0	6	6 2 4	Undergraduate Graduate	Systems); Mathematics (specialization in Mathematics); Mathematics (staro); Mathematics and Computer Science (staro); Computer Science and Technics; Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Computer Science); Mathematics (specialization in Applied Mathematics); Computer Science; Mathematics (specialization in Pure Mathematics); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics)
129.	PMT179 87409	Obnovljivi izvori energije	Renewable Energy Sources	15+15+0+0	2	2 4	Graduate	Engineering Physics (specialization in Thermodynamic Systems); Engineering Physics (specialization in Mechanical Systems); Computer Science and Technics, specialization in Education; Physics (specialization

								in Education); Physics (specialization in Computational Physics)
130.	PMP125 173823	Obrada signala u prirodnim znanostima	Signal Processing in Natural Sciences	30+0+30+0	5	3 1	Graduate	Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics); Physics (specialization in Biophysics)
131.	PPC207 173100	Odabrana poglavlja iz biokemije	Selected Topics in Biochemistry	15+15+0+0	2	6	Undergraduate	Biology and Chemistry
132.	PMP410 202026	Opažačka astronomija	Observational Astronomy	30+15+15+0	5	2	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics)
133.	PMP090 60384	Opća fizika	General Physics	30+0+15+0	4	6 4 2	Undergraduate Graduate	Mathematics (specialization in Mathematics); Mathematics (staro); Mathematics (specialization in Pure Mathematics); Biology; Biology and Chemistry
134.	PMP400 227844	Opća teorija relativnosti i kozmologija	General Relativity and Cosmology	30+0+30+0	6	3	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics)
135.	PMB013 133973	Opća zoologija	Opća zoologija	30+0+45+0	6	1	Undergraduate	Biology; Biology and Chemistry
136.	PMID70 79328	Operacijski sustavi	Operating Systems	30+0+30+0	5	6 2	Undergraduate Graduate	Computer Science and Technics; Computer Science; Physics; Physics (specialization in Computational Physics)
								Mathematics (specialization in Computer Science);

137.	PMM922 173192	Optimizacija	Optimization	30+15+0+0	5	3 1	Graduate	Mathematics (specialization in Pure Mathematics); Mathematics (specialization in Education); Mathematics (specialization in Statistics and Computer Science)
138.	PMC222 240181	Organska kemija	Organic Chemistry	30+15+45+0	6	3	Undergraduate	Biology
139.	PMC005 60922	Organska kemija I	Organic Chemistry I	45+15+0+0	6	3	Undergraduate	Biology and Chemistry
140.	PMP130 251448	Osnove astronomije i astrofizike	Fundamentals of Astronomy and Astrophysics	30+15+0+0	3	5 6 4 3 2 1	Undergraduate Graduate	Physics; Mathematics and Physics, specialization in Education; Physics (specialization in Education); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics); Physics and Computer Science, specialization in Education
141.	PMC224 215199	Osnove bioinformatike	Bioinformatics basics	15+15+15+0	4	3	Undergraduate	Biology
142.	PMM715 201629	Osnovne algebarske strukture	Basic algebraic structures	30+0+30+0	6	6 4 2	Undergraduate Graduate	Mathematics and Physics; Mathematics and Physics, specialization in Education; Mathematics (specialization in Education); Mathematics and Physics (specialization in Education); Mathematics and Physics (Inženjerski)
								Physics; Mathematics (specialization in Education); Physics (specialization in Astrophysics

								and Elementary Particle Physics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics); Mathematics (specialization in Pure Mathematics)
143.	PMM915 160133	Parcijalne diferencijalne jednadžbe	Partial Differential Equations	30+0+30+0	6	6 4 2	Undergraduate Graduate	
144.	PMM915 232416	Partial Differential Equations	Partial Differential Equations	30+0+30+0	6	2	Graduate	Physics (Physics, specialization in Astrophysics and Elementary Particle Physics); Physics (Physics, specialization in Environmental Physics)
145.	PMS170 79121	Pedagogija	Pedagogy	30+15+0+0	3	2	Graduate	Biology and Chemistry, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education; Computer Science, specialization in Education; Computer Science and Technics, specialization in Education; Mathematics (specialization in Education); Mathematics and Physics, specialization in Education; Mathematics and Computer Science, specialization in Education
								Biology and Chemistry,

146.	PMS175216033	Pedagogija adolescencije	Pedagogija adolescencije	15+15+0+0	2	3	Graduate	specialization in Education; Mathematics (specialization in Education)
147.	PMS17279115	Pedagogija slobodnog vremena	Pedagogy of spare time	15+15+0+0	2	3 1	Graduate	Biology and Chemistry, specialization in Education; Physics (specialization in Education); Mathematics (specialization in Education); Mathematics and Physics, specialization in Education
148.	PMP26H251502	Podaci u oceanografiji: izvori, korištenje i upravljanje	Short Course on Marine Data Literacy	20+0+24+0	3	3 1	Graduate	Physics (specialization in Environmental Physics)
149.	PMS140173690	Poučavanje učenika s posebnim potrebama	Teaching students with special needs	15+15+0+0	2	4 2	Graduate	Biology and Chemistry, specialization in Education; Computer Science, specialization in Education; Mathematics and Physics, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education; Mathematics (specialization in Education); Computer Science and Technics, specialization in Education
								Mathematics and Physics, specialization in Education; Physics (specialization in Biophysics); Physics (specialization in Computational Physics); Mathematics

150.	PMP009 68195	Povijest klasične fizike	History of Classical Physics	30+0+0+0	3	3 4 1	Graduate	(specialization in Pure Mathematics); Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Environmental Physics); Physics and Computer Science, specialization in Education
151.	PMP103 68220	Povijest moderne fizike	History of Modern Physics	30+0+0+0	3	2 4	Graduate	Engineering Physics (specialization in Thermodynamic Systems); Engineering Physics (specialization in Mechanical Systems); Mathematics and Physics, specialization in Education; Physics and Computer Science, specialization in Education; Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics)
								Biology and

152.	PMS150 79234	Pozitivna psihologija	Positive psychology	15+15+0+0	2	4 2	Graduate	Chemistry, specialization in Education; Engineering Physics (specialization in Thermodynamic Systems); Engineering Physics (specialization in Mechanical Systems); Computer Science, specialization in Education; Mathematics and Physics, specialization in Education; Physics (specialization in Education); Mathematics (specialization in Education); Computer Science and Technics, specialization in Education
153.	PMP142 251486	Praktikum iz biofizike	Laboratory in Biophysics	10+0+40+0	4	2	Graduate	Physics (specialization in Biophysics)
154.	PMC107 68382	Praktikum iz biokemije	Laboratory Course in Biochemistry	0+0+60+0	4	6	Undergraduate	Biology and Chemistry
155.	PMP012 251446	Praktikum iz elektriciteta i magnetizma	Laboratory in Electricity and Magnetism	0+0+40+0	3	4	Undergraduate	Physics; Mathematics and Physics
156.	PMC113 173113	Praktikum iz fizikalne kemije	Laboratory course in physical chemistry	0+0+45+0	3	2	Graduate	Biology and Chemistry, specialization in Education
157.	PMP011 251438	Praktikum iz mehanike	Laboratory in Mechanics	0+0+40+0	3	3	Undergraduate	Physics; Mathematics and Physics
158.	PMC213 134001	Praktikum iz metodike nastave kemije I	Laboratory in Chemistry Education I	0+0+45+0	2	3	Graduate	Biology and Chemistry, specialization in Education
159.	PMC214 134011	Praktikum iz metodike nastave kemije II	Laboratory in Chemistry Education II	0+0+45+0	3	4	Graduate	Biology and Chemistry, specialization in Education
								Physics (specialization in Education); Physics (specialization in Astrophysics

160.	PMP20F 186482	Praktikum iz moderne fizike	Laboratory in Modern Physics	0+0+40+0	3	1	Graduate	and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Computational Physics); Physics and Computer Science, specialization in Education
161.	PPB282 79353	Praktikum iz molekularne genetike	Praktikum iz molekularne genetike	0+0+30+0	2	6 2	Undergraduate Graduate	Biology and Chemistry; Biology and Chemistry, specialization in Education
162.	PMC007 60944	Praktikum iz organske kemije	Laboratory Course in Organic Chemistry	0+0+60+0	4.5	4	Undergraduate	Biology and Chemistry
163.	PMP014 251452	Praktikum iz termodinamike i moderne fizike	Laboratory in Thermodynamics and Modern Physics	0+0+40+0	3	6	Undergraduate	Physics; Mathematics and Physics
164.	PMP013 251449	Praktikum iz valova i optike	Laboratory in Waves and Optics	0+0+40+0	3	5	Undergraduate	Physics; Mathematics and Physics
165.	PMIG10 87288	Primijenjena statistika	Applied Statistics	30+0+30+0	6	3 4	Undergraduate	Computer Science
166.	PMP074 251427	Primjena programiranja u fizici	Application of Programming in Physics	30+0+30+0	5	2	Undergraduate	Physics
167.	PMS171 79235	Primjena statistike u istraživanju obrazovanja	Statistics in research of education	30+0+15+0	3	4 2	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education; Computer Science and Technics, specialization in Education; Mathematics (specialization in Education)
168.	PMP162 61264	Prirodne znanosti i okoliš	Natural Science and the Environment	30+0+10+0	4	5 3	Undergraduate	Physics; Mathematics (specialization in Mathematics); Mathematics

								(staro)
169.	PPC210 79371	Prirodni toksini u moru	Natural toxins in the sea	15+0+0+0	2	6	Undergraduate	Biology and Chemistry
170.	PMIC60 79327	Programiranje mrežnih aplikacija	Network Application Programming	30+0+30+0	5	6 4 2	Undergraduate Graduate	Computer Science and Technics; Physics; Mathematics (specialization in Computer Science); Mathematics and Computer Science (staro); Computer Science; Physics (specialization in Computational Physics)
171.	PMID45 164969	Programske paradigme	Programming paradigms	30+0+30+0	5	4 2	Graduate	Computer Science, specialization in Education; Mathematics (specialization in Computer Science); Mathematics (specialization in Statistics and Computer Science); Mathematics and Computer Science, specialization in Education
172.	PMM501 227877	Prostorna statistika s primjenama	Applied spatial statistics	30+0+30+0	4	4 3	Graduate	Mathematics (specialization in Computer Science); Mathematics (specialization in Pure Mathematics); Mathematics (specialization in Statistics and Computer Science)
								Biology and Chemistry, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education;

173.	PMS007 79106	Psihologija odgoja i obrazovanja I	Educational Psychology 1	30+15+0+0	3	1	Graduate	Computer Science, specialization in Education; Computer Science and Technics, specialization in Education; Mathematics (specialization in Education); Mathematics and Physics, specialization in Education; Mathematics and Computer Science, specialization in Education
174.	PMS116 60986	Psihologija odgoja i obrazovanja II	Educational Psychology II	30+15+0+0	3	2	Graduate	Biology and Chemistry, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education; Computer Science, specialization in Education; Computer Science and Technics, specialization in Education; Mathematics (specialization in Education); Mathematics and Physics, specialization in Education; Mathematics and Computer Science, specialization in Education
175.	PMS109 60525	Psihologija samopouzdanja i pozitivnog mišljenja	Psychology of self-confidence and positive thinking	15+15+0+0	2	6 4 2	Undergraduate Graduate	Computer Science; Physics; Biology and Chemistry, specialization in Education; Mathematics (specialization in Mathematics);

								Mathematics (staro); Computer Science and Technics
176.	PMII60 147925	Računalni vid	Computer vision	30+0+30+0	5	6 4 2	Undergraduate Graduate	Computer Science; Physics and Computer Science, specialization in Education; Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Computer Science); Computer Science and Technics, specialization in Education; Computer Science, specialization in Education
177.	PMP409 99714	Računarske metode i njihova primjena u nano i biofizici	Computer Methods and Applications in Nano and Biophysics	30+15+0+0	5	3	Graduate	Physics (specialization in Biophysics)
178.	PMIH12 186496	Raspodijeljene i nerelacijske baze podataka		30+0+30+0	5	4 2	Graduate	Computer Science, specialization in Education; Mathematics (specialization in Computer Science); Mathematics (specialization in Statistics and Computer Science); Data science and engineering
179.	PMIC50 148038	Raspodijeljeni sustavi	Distributed systems	30+0+30+0	5	4 2	Graduate	Physics and Computer Science, specialization in Education; Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Computer Science);

								Computer Science and Technics, specialization in Education; Computer Science, specialization in Education
180.	PPC221 201658	Razvoj i optimizacija analitičkih metoda	Development and optimization analytical chemical methods	0+0+30+0	2	6	Undergraduate	Biology and Chemistry
181.	PMP274 251500	Simetrije u fizici	Symmetries in Physics	30+0+30+0	6	1	Graduate	Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Computational Physics)
182.	PMS108 133963	Sociologija odgoja i obrazovanja	Sociology of Education	15+15+0+0	2	3 1	Graduate	Biology and Chemistry, specialization in Education; Computer Science, specialization in Education; Physics (specialization in Education); Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Education); Computer Science and Technics, specialization in Education; Mathematics and Physics, specialization in Education
183.	PMS111 60523	Sociologija znanosti	Sociology of science	15+15+0+0	2	5 3	Undergraduate	Physics; Mathematics (specialization in Mathematics); Mathematics (staro); Computer Science
184.	PMB282 173106	Specijalna mikrobiologija	Specijalna mikrobiologija	15+0+15+0	2.5	1	Graduate	Biology and Chemistry, specialization

								in Education
185.	PMP115 207233	Statistička fizika	Statistical Physics	30+15+15+0	5	6	Undergraduate	Physics
186.	PMM861 201568	Statistika	STATISTICS	30+0+15+0	4	2	Undergraduate	Biology
187.	PMM911 160162	Statistika u računarstvu	STATISTICS IN COMPUTER SCIENCE	30+0+30+0	5	1	Graduate	Mathematics (specialization in Computer Science); Mathematics (specialization in Statistics and Computer Science)
188.	PMP271 148176	Stohastičke simulacije u klasičnoj i kvantnoj fizici	Stochastic Simulations in Classical and Quantum Physics	30+0+30+0	6	2	Graduate	Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics)
189.	PMIH21 211922	Strojno učenje	Machine Learning	30+0+30+0	5	3 1	Graduate	Mathematics (specialization in Statistics and Computer Science); Computer Science, specialization in Education; Mathematics (specialization in Computer Science); Data science and engineering
190.	PMP26G 251488	Svjetlost i fotosinteza u moru	Light and Photosynthesis in the Sea	30+20+0+0	4	1	Graduate	Physics (specialization in Biophysics); Physics (specialization in Environmental Physics)
191.	PMP071 159411	Tekstualni i grafički programi za fizičare	Text and Graphical Programs for Physicists	0+0+30+0	1	1	Undergraduate	Physics; Mathematics and Physics

192.	PMP106 63969	Temeljni pojmovi u fizici	Fundamental Concepts in Physics	30+15+0+0	3	5 3	Undergraduate Graduate	Physics; Mathematics (specialization in Mathematics); Mathematics (staro); Mathematics (specialization in Pure Mathematics)
193.	PMM614 245245	Teorija dizajna	Design Theory	45+0+0+0	5	4 2	Graduate	Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Computer Science); Mathematics (specialization in Pure Mathematics); Mathematics (specialization in Education); Mathematics (specialization in Statistics and Computer Science)
194.	PMM806 201744	Teorija grafova	Graph theory	30+0+30+0	5	6 4 2	Undergraduate Graduate	Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (staro); Mathematics and Computer Science (staro); Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Statistics and Computer Science)
195.	PMM127 111893	Teorija igara	Teorija igara	30+0+30+0	5	3	Graduate	Mathematics and Physics, specialization in Education; Mathematics and Computer Science, specialization in Education

196.	PMM127 227878	Teorija igara	Game Theory	45+0+15+0	5	5 3 1	Undergraduate Graduate	Mathematics (specialization in Mathematics); Mathematics (staro); Mathematics and Physics, specialization in Education; Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Computer Science); Mathematics (specialization in Education); Mathematics (specialization in Statistics and Computer Science)
197.	PMP401 251499	Teorija relativnosti	Relativity	30+0+30+0	4	3 1	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Computational Physics); Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics and Computer Science, specialization in Education
198.	PMM112 79236	Teorija skupova	Set theory	30+0+30+0	6	4	Undergraduate Graduate	Mathematics (staro); Mathematics and Computer Science (staro); Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (specialization in Applied

								Mathematics); Mathematics and Physics, specialization in Education
199.	PMB033 173071	Terenska nastava iz kralježnjaka	Field Training in Vertebrates	15+0+0+0	0.5	5	Undergraduate	Biology; Biology and Chemistry
200.	PMP007 251443	Termodinamika	Thermodynamics	60+15+30+0	9	4	Undergraduate	Physics; Mathematics and Physics
201.	PMP20C 251496	Termodinamika nepovratnih procesa	Irreversible Process Thermodynamics	45+0+15+0	6	3	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Biophysics); Physics (specialization in Computational Physics)
202.	PMS132 78979	Tjelesna i zdravstvena kultura II	Tjelesna i zdravstvena kultura II	0+0+30+0	1	2	Undergraduate	Physics
203.	PMS131 78978	Tjelesna i zdravstvena kultura I	Tjelesna i zdravstvena kultura I	0+0+30+0	1	1	Undergraduate	Physics
204.	PMB535 212271	Toksičnost školjkaša	Shellfish toxicity	15+0+0+0	2	3	Undergraduate	Biology
205.	PMB735 254797	Toxicology	Toxicology	30+0+0+0	3	5 1	Undergraduate Graduate	Biology and Chemistry; Biology and Chemistry, specialization in Education
206.	PMII70 147945	Trodimenzionalno projektiranje fizičkih objekata	Three-dimensional design of physical objects	30+0+30+0	5	6 4 2	Undergraduate Graduate	Computer Science; Computer Science, specialization in Education; Physics and Computer Science, specialization in Education; Computer Science and Technics, specialization in Education
								Biology and Chemistry, specialization in Education; Computer Science, specialization in Education; Physics (specialization

207.	PMS16079109	Upravljanje razredom	Classroom management	15+15+0+0	2	3 1	Graduate	in Education); Physics and Computer Science, specialization in Education; Mathematics (specialization in Education); Computer Science and Technics, specialization in Education; Mathematics and Physics, specialization in Education
208.	PMP20497418	Uvod u atomsku i molekularnu fiziku	Introduction to Atomic and Molecular Physics	30+30+0+0	6	4 2	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Education); Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics)
209.	PMM12068173	Uvod u diferencijalnu geometriju	Introduction to differential geometry	30+0+30+0	6	6 4 2	Undergraduate Graduate	Physics; Mathematics and Physics, specialization in Education; Mathematics (specialization in Education); Physics (specialization in Computational Physics); Mathematics (specialization in Pure Mathematics)
								Mathematics (staro); Mathematics (specialization

210.	PMM505 215364	Uvod u financijsku matematiku	Introduction to financial mathematics	30+0+30+0	5	4	Undergraduate Graduate	in Mathematics); Mathematics and Computer Science, specialization in Education
211.	PMP096 79401	Uvod u fiziku	Introduction to Physics	45+0+15+0	4	2	Undergraduate	Computer Science and Technics
212.	PMP160 67165	Uvod u geofiziku	Introduction to Geophysics	30+0+15+0	4	6 4	Undergraduate Graduate	Physics; Mathematics and Physics, specialization in Education; Physics and Computer Science, specialization in Education
213.	PMM151 240185	Uvod u matematičku analizu	Introduction to mathematical analysis	45+0+60+0	8.5	1	Undergraduate	Mathematics; Mathematics and Physics; Mathematics and Computer Science, specialization in Education
214.	PMM700 201624	Uvod u matematičku logiku i teoriju skupova	Introduction to Mathematical Logic and Set Theory	30+0+30+0	5	5 3	Undergraduate	Mathematics and Physics; Mathematics and Computer Science, specialization in Education; Mathematics and Physics (specialization in Education); Mathematics and Physics (Inženjerski)
215.	PMP261 216053	Uvod u mehaniku fluida	Introduction to Fluid Mechanics	30+0+30+0	6	3 1	Graduate	Physics (specialization in Biophysics); Physics (specialization in Computational Physics); Physics (specialization in Environmental Physics)
216.	PMM108	Uvod u numeričku	Introduction to Numerical	30+0+30+0	5	5	Undergraduate	Mathematics (specialization in Computer Science); Mathematics (staro); Mathematics and Computer Science (staro);

	60990	matematiku	Mathematics			3		Mathematics (specialization in Mathematics); Mathematics (specialization in Applied Mathematics)
217.	PMP165 216064	Uvod u obradu podataka	Introduction to Data Analysis	20+0+30+0	5	2	Graduate	Physics (specialization in Environmental Physics)
218.	PMM701 215311	Uvod u primijenjenu matematiku	Introduction to Applied Mathematics	30+0+30+0	5	5 6 4	Undergraduate	Mathematics and Computer Science, specialization in Education
219.	PMIA10 240163	Uvod u računarstvo	Introduction to Computing	30+15+30+0	6	5 3 1	Undergraduate	Physics; Computer Science and Technics; Computer Science
220.	PMP114 215238	Uvod u statističku fiziku	Introduction to Statistical Physics	30+0+30+0	5	5 1	Undergraduate Graduate	Physics; Mathematics and Physics; Mathematics and Physics (specialization in Education); Mathematics and Physics (Inženjerski); Physics and Computer Science, specialization in Education
221.	PMM102 148613	Uvod u teoriju brojeva	Introduction to Number Theory	30+0+30+0	5	4	Undergraduate	Mathematics (staro); Mathematics and Computer Science (staro); Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics and Physics (specialization in Education); Mathematics and Physics

222.	PMM114 67191	Uvod u topologiju	Introduction to topology	30+0+30+0	6	6	Undergraduate	Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (specialization in Applied Mathematics); Mathematics (staro); Mathematics and Computer Science (staro)
223.	PMII10 79324	Uvod u umjetnu inteligenciju	Introduction to Artificial Intelligence	30+0+30+0	5	5 3 1	Undergraduate Graduate	Computer Science; Physics; Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (staro); Mathematics and Computer Science (staro); Mathematics (specialization in Pure Mathematics); Mathematics (specialization in Education); Physics and Computer Science, specialization in Education; Computer Science and Technics, specialization in Education
								Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Mathematics); Mathematics (specialization

224.	PMM716201635	Uvod u vjerojatnost	INTRODUCTION OF PROBABILITY	45+0+45+0	8	6 2	Undergraduate Graduate	in Computer Science); Mathematics (specialization in Applied Mathematics); Mathematics (staro); Mathematics and Computer Science (staro); Mathematics and Physics, specialization in Education
225.	PPC21479374	Uvod u znanstveni rad	Introduction to the scientific work	15+15+0+0	2	5 1	Undergraduate Graduate	Biology and Chemistry; Biology and Chemistry, specialization in Education
226.	PMP006251436	Valovi i optika	Waves and Optics	60+15+30+0	9	5 3	Undergraduate	Mathematics (specialization in Applied Mathematics); Physics; Mathematics and Physics
227.	PMM20179128	Vektorski prostori I	Vector spaces I	30+0+30+0	6	5 3 4 1	Undergraduate Graduate	Mathematics (specialization in Mathematics); Mathematics (specialization in Computer Science); Mathematics (specialization in Applied Mathematics); Mathematics (staro); Mathematics and Computer Science (staro); Mathematics and Physics, specialization in Education; Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Education)
228.	PMM603245250	Vektorski prostori II	Vector spaces II	45+0+0+0	6	1	Graduate	Mathematics (specialization in Pure Mathematics)
229.	PMC204252519	Viši praktikum iz biokemije	Advanced Laboratory Course in	0+0+30+0	2	1	Graduate	Molecular Biology

			Biochemistry					
230.	PMM228 148588	Vjerojatnost I	Probability I	30+0+30+0	6	4 2	Graduate	Mathematics (specialization in Computer Science); Mathematics (specialization in Pure Mathematics); Mathematics (specialization in Statistics and Computer Science)
231.	PMM809 173379	Vrednovanje u nastavi	ASSESSMENT IN EDUCATION	0+30+0+0	3	4 2	Graduate	Mathematics and Physics, specialization in Education; Mathematics and Computer Science, specialization in Education; Mathematics (specialization in Education)
232.	PMC209 201659	Zelena kemija	Green Chemistry	15+0+15+0	2	1	Graduate	Biology and Chemistry, specialization in Education
233.	PMP105 173817	Znanstvena komunikacija	Scientific Communication	20+10+0+0	2	4 2	Graduate	Mathematics and Physics, specialization in Education; Physics (specialization in Education); Physics and Computer Science, specialization in Education; Physics (specialization in Astrophysics and Elementary Particle Physics); Physics (specialization in Biophysics); Physics (specialization in Environmental Physics); Physics (specialization in Computational Physics)

Subject name	3D printing						
ID	PMT201	Study year	1.				
Lecturer	doc. dr. sc. Ivan Peko	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	30	0	
Subject status	Elective	Online percentage	0%				

Subject description

Subject goals	– To be informed about different processes and technologies of 3D printing and the possibilities of their application in different branches of industry, medicine, dentistry, bioengineering, biotechnology, nanotechnology... – Develop skills for 3D design and creation of designed models on devices and machines for 3D printing – Acquire skills about all stages of the 3D printing process and producing a functional product – To be informed about the possibilities of connecting 3D printing and 3D scanning and other 3D technologies with the aim of applying them in different fields: in industry, medicine, dentistry, bioengineering, biotechnology...
Enrolment requirements	None.
Learning outcomes	Learning outcomes expected at the level of the course (4 to 10 learning outcomes) – Describe different 3D printing procedures and processes – Choose the appropriate 3D printing technology depending on specific requirements and applications – Choose a suitable material for making the desired product using the 3D printing process – Define suitable parameters on the machine/device for 3D printing with the aim of obtaining a quality printed product – Plan the 3D printing process from the initial design to the final product – Connect 3D scanning with 3D printing – Design own product in 3D design software and produce it on a 3D printer
Syllabus	Lectures: 1. Introduction to 3D printing, historical development of the technology 2. Application of 3D printing 3. Phases and flow of the 3D printing process 4. 3D printing processes: production from liquid materials 5. 3D printing processes: production from powder materials 6. 3D printing processes: production from solid materials 7. Machines and devices for 3D printing, 3D printing parameters settings 8. Materials for 3D printing 9. Design for 3D printing 10. 3D printing in industry 11. 3D / 4D printing in medicine, dentistry 12. 3D / 4D printing in bioengineering and biotechnology 13. 3D printing in nanotechnology 14. Future perspectives and trends in the development of 3D printing 15. 3D scanning, connecting 3D scanning and 3D printing, reversible engineering Exercises: Week 1 – Week 7: 3D design on the computer Week 8 – Week 10: 3D design of own product on the computer Week 11 – Week 13: 3D printing of designed products Week 14: 3D scanning. Connection between 3D scanning and 3D printing. Reversible engineering.

Teaching types	[x] Lectures [x] Seminars [x] Exercises [ ] Fully online [ ] Combined online	[ ] Fieldwork [ ] Individual assignments [x] Multimedia [x] Laboratory [ ] Mentoring	[x] Radionice [ ] [ ] [ ]
Student obligations	Active participation in lectures and constructive/practical exercises.		

Monitoring student work	Class attendance	1	Research		Practical work	1
	Experimental work	1	Paper			

	Essay		Seminar paper			
	Colloquiums	1	Oral exam			
	Written exam	1	Project	1		

Assessment and evaluation of student work	2 tests (midterm exams)/final exam from the theoretical part Grade = (K1 + K2)/2 (K1: result of the 1st test, K2: result of the 2nd test)
	Rating by percentages: 50 – 62%: sufficient (2), 63 – 75%: good (3), 76 – 87%: very good (4), 88 – 100%: excellent (5)

Required literature	Title	Number of copies available	Availability on other medium
	Andreas Gebhardt, Jan-Steffen Hötter: Additive Manufacturing – 3D Printing for Prototyping and Manufacturing, Hanser Publications, Cincinnati, 2016.		
	Ben Redwood, Filemon Schöffer, Brian Garret: The 3D Printing Handbook –Technologies, design and applications, 3D Hubs, Amsterdam, 2017.		
	Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani: Additive ManufacturingTechnologies, Springer, 2021.		
	Mohammed Maniruzzaman: 3D and 4D Printing in Biomedical Applications, Wiley-VCH, 2019.		
	Georgios Tsoulfas, Petros I. Bangeas, Jasjit S. Suri: 3D Printing: Applications in Medicine and Surgery, Elsevier, 2020.		
	Deepak M. Kalaskar: 3D Printing in Medicine, Elsevier, 2017.		
	Sanjay ¬Kumar: Additive Manufacturing Processes, Springer, 2020.		
	John O. Milewski: Additive Manufacturing of Metals – From Fundamental Technology to Rocket Nozzles, Medical Implants, and Custom Jewelry, Springer, 2017.		
	Ehsan Toyserkani, Dyuti Sarker, Osezua Obehi Ibhadode, Farzad Liravi, Paola Russo, Katayoon Taherkhani: Metal Additive Manufacturing, Wiley, 2022.		
Supplementary literature	Richard Leach, Simone Carmignato: Precision Metal Additive Manufacturing, CRC Press, 2021.		
Quality assurance	Conversation with students, student evaluation using an anonymous survey, student success in the exam, self-assessment.		
Other (in the opinion of the proponent)			

Subject name	Algebra I		
ID	PMM602	Study year	1.
Lecturer	doc. dr. sc. Gordan Radobolja	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 45, S: 0, E: 0, P: 0
Subject status	Compulsory	Online percentage	30%

Subject description	
Subject goals	This course is the first part of a standard graduate algebra course which considers group and ring theory. In particular, the emphasis is on free groups, finitely generated abelian groups, their subgroups, certain classes of commutative rings with identity and certain classes of ideals. The gained knowledge should serve as a basis for the second part of the course and for continuation of studies on the postgraduate level.
Enrolment requirements	Successful completion of undergraduate courses which consider algebraic structures; in internal case: Vector spaces I and Algebraic structures.
Learning outcomes	Upon successful completion of the course student should understand fundamental concepts of group and ring theory; demonstrate familiarity with terminology of category theory; distinguish the complexity of group structure problem in abelian and nonabelian case; be able to give presentations of groups; be capable of describing a structure of finitely generated abelian group; distinguish certain classes of commutative rings by their specific division (factorization) properties; show capacity for mathematical reasoning through analysing, proving and explaining major results; demonstrate accurate and efficient use of advanced algebraic techniques.
Syllabus	Groups, categories, direct products and direct sums, internal products and sum. Product of a family of homomorphisms. (6 hours) Free groups, free products, free abelian groups and their subgroups. Structure theory of finitely generated abelian groups. (6 hours) The action of a group on a set. (2 hours) The Sylow theorems. (2 hours) Nilpotent and solvable groups. (2 hours) Rings and homomorphisms of rings, ideals (prime and maximal ideals), direct product of rings. Chinese remainder theorem. (6 hours) Factorization in rings, prime and irreducible elements. (2 hours) Principal ideal domains, Euclidean and unique factorization domains. (2 hours) Rings of fractions. Local rings (2 hours)
Teaching types	[x] Lectures [x] Seminars [ ] Exercises [ ] Fully online [ ] Combined online [ ] Fieldwork [x] Individual assignments [ ] Multimedia [ ] Laboratory [ ] Mentoring [ ] [ ] [ ] [ ]

<table>
<tr><td>Student obligations</td><td colspan="6">Attending classes, giving report(s) on the research done in order to solve the appointed project problem and taking oral exam.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>3.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Attending classes, giving report(s) on the research done in order to solve the appointed project problem and taking oral exam.</td></tr>
<tr><td rowspan="2">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">T. W. Hungerford, Algebra, Springer, New York, 1996.</td><td></td><td>Pdf file on the Moodle platform</td></tr>
<tr><td>Supplementary literature</td><td colspan="6">D. S. Dummit, R.M. Foote, Abstract Algebra, J. Wiley and Sons, Inc., 2004.

S. Lang, Algebra, Addison-Wesley Publishing Company, Redwood City, California, 1984.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Exam results statistics. Students' quality assessment at the end of the semester carried out by the University authorized committee through anonymous polls.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

Subject name	Algebra II		
ID	PMM606	Study year	1.
Lecturer	doc. dr. sc. Gordan Radobolja	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 45, S: 0, E: 0, P: 0
Subject status	Compulsory	Online percentage	0%
Subject description			
Subject goals	State the most important results on polynomials and polynomial rings with the emphasis on polynomials over a field. Set the theory of algebraic field extensions and prove the fundamental theorem of algebra. Prove the fundamental theorem of Galois theory and as a consequence, unsolvability of the quintic. Set the fundations of theory of modules over arbitrary ring. Prepare the students for more advanced algebraic courses on graduate and postgraduate level.		
Enrolment requirements	Courses passed: Algebraic structures and Vector spaces I, Courses taken: Algebra I.		
Learning outcomes	Students will be able to: interpret formal polynomials in terms of categories distinguish a formal polynomial and a poynomial function compare free modules over arbitrary rings and vector spaces connect algebraic field extensions with group theory argue on unsolvability of classical Greek problems in terms of field extensions conclude weather a given algebraic equation is solvable using Galois theory		
Syllabus	Ring of quotients (2) Algebras (2) Polynomial rings (3) Roots of polynomials (1) Factorization in polynomial rings (3) Modules and homomorphisms (4) Sums, products and exact sequences of modules (3) Hom functor (2) Free modules (3) Tensor product of modules (4) Algebraic field extensions (3) Classical Greek problems (1) Splitting fields and algebraic closures (4)		

	Galois theory (4) Applications of Galois theory (3) Abel's theorem (3)
Teaching types	☑ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Lectures and exercises attendances are obligatory. Students should write and present seminars.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums	1	Oral exam	2		
Written exam		Project			

Assessment and evaluation of student work	Students present one seminar and write two tests. These are prerequisites for oral exam. Final grade is based on seminar (20%), tests (30%) and oral exam (50%).

Required literature

Title	Number of copies available	Availability on other medium
T. W. Hungerford, Algebra, Springer, 2003		
D. S. Dummit, R. M. Foote, Abstract algebra, Wiley, 2003		

Supplementary literature	S. Lang, Algebra, Springer 3rd edition, 2005
Quality assurance	Discussion in classes and official student survey.
Other (in the opinion of the proponent)	

Subject name	Analytical methods						
ID	PMC223	Study year	2.				
Lecturer	doc. dr. sc. Ivana Mitar	Points value (ECTS)	4.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	15	30	0	
Subject status	Compulsory	Online percentage	10%				
Subject description							
Subject goals	Understanding of basic principles and application of classical methods of qualitative and quantitative analysis and basic instrumental methods.						
Enrolment requirements	Completed course Basic and Inorganic Chemistry.						
Learning outcomes	Upon completion of the course, students will be able to: 1.define the basic concepts of analytical chemistry, 2.distinguish between quantitative and qualitative analysis, 3.explain the physical and chemical principles of each method of classical analysis, 4.participate in the selection of the appropriate analytical method, depending on the nature of the sample to be analyzed, 5.understand and apply appropriate laboratory or instrumental methods, and 6.participate in the calculation, explanation, and interpretation of analytical results.						
Syllabus	LECTURES: 1.Definition, importance, and classification of analytical chemistry Chemical analysis: qualitative and quantitative Analytical process (problem definition, sampling, choice of analytical methods, analytical signal, report) Safety of laboratory work 2.Chemical equilibrium Equilibrium constants 3.Acid-base equilibria Acid and base strength; autoprotolysis of water. 4.Activity and activity coefficient Ionic strength of the solution 5.Acid-base buffer Buffer preparation; buffer capacity 6.Salt hydrolysis Hydrolysis constant. 7.Equilibria of complex formation Individual and sum constants of stability of complexation 8.Equilibrium between a solid, poorly soluble substance and its ions Solubility, solubility product constant 9.Oxidation-reduction equilibria Standard electrode potential, electrode potential, Nernst equation 10.Quantitative chemical analysis 11.Titrimetric methods of analysis Titration, equivalence point, end point; primary and secondary standards; standardization of solutions; indicators; titration curves. Classification of titrimetric methods 12.Gravimetric methods Precipitation reagents; types of precipitate; gravimetric factor 13.Electroanalytical methods Potentiometry; electrogravimetry 14.Spectroscopy Basic principles of UV / VIS and IR spectroscopy. 15.Chromatography Basic principles of surface and column chromatography (HPLC, GC). SEMINAR: Solving numerical examples related to the theoretical material covered. EXERCISE: 1.Basic actions in the laboratory of quantitative chemical analysis 2.Basic principles of solution preparation and safety in the laboratory 3.Preparation of solutions for quantitative analysis 4.Preparation of buffer solutions						

	5.Hydrolysis of salts 6.Standardization of titrants: hydrochloric acid and sodium hydroxide 7.Alkalimetry: determination of ascorbic acid 8.Complexometry: determination of water hardness 9.Methods based on precipitation reactions: determination of chloride ions according to Mohr method 10.Methods based on redox reactions: determination of ascorbic acid 11.Electrogravimetric separation of copper and nickel in the sample 12.Spectrophotometric determination of copper 13.Spectrophotometric determination of iron 14.Pigment analysis by IR spectrophotometry 15.Exercise review					
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online		☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring		☐ ☐ ☐ ☐	
Student obligations	Students are required to attend classes (lectures and seminars 80 %, laboratory practice 100 %) and actively participate in the teaching process. That will be recorded and evaluated in making a final assessment					
Monitoring student work	Class attendance	0.5	Research		Practical work	1
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam	1		
	Written exam	1.5	Project			
Assessment and evaluation of student work	All laboratory exercises must be completed. The grade for the laboratory exercises will be based on the laboratory work. The final grade for the course will consist of a written (seminar) and an oral part (lecture) and laboratory examination. The written part may be taken in whole or in part by partial examinations during the semester. The exams will be graded as follows: more than 60 % – adequate, more than 70 % – good, more than 80 % – very good and more than 90 % – excellent. The oral part of the examination is taken by the students after successfully passing the written examination (partially or completely).					

Required literature

Title	Number of copies available	Availability on other medium
D. A. Skoog, D. M. West, F. J. Holler, Osnove analitičke kemije, Školska knjiga, Zagreb, 1999.	10	
I. Mitar, Laboratorijske vježbe za kolegije iz analitičke kemije (interna, nerecenzirana skripta)		

Supplementary literature	1.R. Kellner, J. M. Mermet, M. Otto, M. Valcarcel and H. M. Widmer, Analytical Chemistry (A Modern Approach to Analytical Science, Second Edition), Wiley-VCH, Verlag Gmbh & Co. KGaA, Weinheim, 2004. 2.D. C. Harris, Quantitative Chemical Analysis, W. H. Freeman and Company, 41 Madison Avenue New York, NY, 2016. 3.B. M. Tissue, Basic of Analytical Chemistry and Chemical Equilibria, John Wiley & Sons, Inc., Hoboken, New Jersey, NY, 2013. 4.G. D. Christian, P. K. Dasgupta, K. A. Schug, Analytical Chemistry, John Wiley & Sons, Inc., 111 River Street, Hoboken, New Jersey, NY, 2014.
Quality assurance	Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Complex networks analysis</td></tr>
<tr><td>ID</td><td>PMM502</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Tanja Vojković</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The objective of this course is to introduce students to new and fast growing field of complex networks. Mathematicaly, complex network is a graph, so concepts and results from graph theory are largely used. Students will learn about basic notions of networks and their analysis through lectures and through auditory excercises and homeworks they will pratice tools for analysis, vertex centrality measures, imoportant edges and paths, community detection and epidemic models.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Graph theory course and Data structure and algorithms course must be passed, and knowledge of basic algotihm complexity is preferable.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Students will be able to:
– explain the importance of complex networks and motivation for their analysis
– explain basic measures for structure of complex netwotks
– implement basic algorithms for analysis
– explain the process and methods of community detection and know basic algorithms for community detection
– talk about models of epidemic spread</td></tr>
<tr><td>Syllabus</td><td colspan="3">– Introduction to complex networks, types and properties, classification – 2 hours
– Network representation, Laplacian, eigenvalues – 2 hours
– Measures and metrices (centrality)– 2 hours
– Groups of vertices (cliques, cores, components, transitivity, clustering) – 4 hours
– Substructures (communities, components) – 3 hours
– Basic algorithms on networks – 5 hours
– Complex algorithms on networks – 5 hours
– Processes on networks (epidemics, SI, SIR, SIRS) – 5 hours</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring
☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Pohađanje nastave, rješavanje domaćih zadaća</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1; Research: ; Practical work:
Experimental work: ; Paper: ; Domaće zadaće: 1
Essay: ; Seminar paper:
Colloquiums: 1; Oral exam: 2
Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The exam which requires solving practical and theoretical through homework and an oral theoretical exam. Passed homework is a prerequisite for the oral exam.</td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
M.E.J. Newman: Networks, An Introduction, Oxford University Press, London, 2010. | | </td></tr>
<tr><td>Supplementary literature</td><td colspan="3">D. Veljan: Kombinatorna i diskretna matematika A. Golemac: Teorija grafova, skripta</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.</td></tr>
</table>

Other (in the opinion of the proponent)	

Subject name	Data Analysis in High Energy Physics		
ID	PMP272	Study year	2.
Lecturer	doc. dr. sc. Toni Šćulac	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Elective	Online percentage	30%

Subject description

Subject goals	Teaching students basics of data analysis in high energy physics.
Enrolment requirements	Introduction to elementary particles.
Learning outcomes	Students are expected to: – Understand and describe how LHC works – Understand basics of the Standard Model – Explain the workflow of data analysis – Know how to work with the ROOT programming package – Understand probability theory: frequentist and Bayesian – Understand Monte Carlo simulation – Explain particle interactions with matter – Explain estimators, likelihood, maximum likelihood, and extended maximum likelihood method – Explain confidence intervals and know how to determine them for different estimators – Explain Neymann and Bayesian confidence intervals – Explain hypothesis testing and p-value
Syllabus	1. LHC physics and the Standard Model 2. Data analysis in HEP 3. ROOT programming package 4. Probability and statistics 5. Monte Carlo simulations in HEP 6. Distributions and estimators 7. Likelihood, maximum likelihood and extended maximum likelihood methods 8. Confidence intervals 9 9. Hypothesis testing and p-value
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Attend at least 70% of lectures and 70% of exercises.

Monitoring student work

Class attendance	2	Research		Practical work	2
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam	1		
Written exam	1	Project			

Assessment and evaluation of student work	The final grade is formed after the student passes both test parts: – written exam (problem solving on computer, 50% rating) and – oral exam (theory, 50% rating).

Required literature

Title	Number of copies available	Availability on other medium
Statistical Data Analysis, Oxford Science Publications, 1st edition, Glen Cowan		

Supplementary literature	Slides from lectures.
Quality assurance	Anonymous student questionnaire and course evaluation performed by the University of Split.
Other (in the opinion of the proponent)	

Subject name	Neural Network Architectures		
ID	PMII15	Study year	2.
Lecturer	doc. dr. sc. Goran Zaharija	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description

Subject goals	Recent advances in Artificial neural networks and deep learning have fundamentally changed the field of machine learning, especially with regarding the range of applications in which they offer superior performance. This course offers a practical overview of modern machine learning methods with special emphasis on deep learning approaches. Through the course, students will become familiar with the most commonly used neural network architectures and will create their own models of these architectures through practical examples.
Enrolment requirements	
Learning outcomes	After passing the course, students will be able to: 1. recognize the basic models of deep machine learning: convolutional neural networks (CNN), feedback and recursive neural networks (RNN, LSTM, GRU), and generative neural networks (GAN) 2. describe the basic algorithms for learning in deep neural networks, based on gradient descent (BP, BPTT) 3. explain the principles of robust deep learning using regularization in neural networks (L1, L2, dropout, blackout) 4. analyze and evaluate neural networks intrinsically and extrinsically 5. implement solutions based on deep learning using modern software libraries (Keras, TensorFlow) 6. form solutions based on deep neural networks, using various data sources like images, text, and similar unstructured data
Syllabus	1. Introduction and course overview (2+2) 2. Multilayer perceptron (MLP) and backpropagation (BP) (2+2) 3. Approaches to the regularization of neural networks (2+2) 4. Learning Optimizations in neural networks (2+2) 5. Convolutional neural networks (CNN) (2+2) 6. Recurrent neural networks (RNN) and learning by backpropagation through time (BPTT) (2+2) 7. Recursive neural networks (2+2) 8. Vanishing gradients problem and advanced variants of neural networks (long short-term memory, LSTM, en. gated recurrent unit, GRU) (2+2) 9. Generative neural models of deep learning (generative adversarial networks, GAN) (2+2) 10. Simultaneous learning with neural networks (en. multi-task learning, MTL) (2+2) 11. Learning vector descriptions of data (2+2) 12. Practical deep learning, parameters, and evaluation (2+2) 13. In-depth learning in image, text, and speech processing (2+2) 14. Limitations of deep learning and active areas of research (2+2) 15. Exam preparation (2+2)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Regular class attendance, practical assignment

Monitoring student work

Class attendance	1.5	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	0.5	Oral exam			
Written exam	2	Project	1		

Assessment and evaluation	Tasks (25%)

of student work	Project (25%) Written exam (50%) Students must pass each of the components		
Required literature	Title	Number of copies available	Availability on other medium
	Goodfellow, Bengio, Courville: Deep learning. 2016.		https://www.deeplearningbook.org/
	Bishop. Pattern Recognition and Machine Learning. Springer, 2010		
	Murphy. Machine Learning: A Probabilistic Perspective. MIT Press, 2012.		
	Daume III: A Course in Machine Learning. 2015.		http://ciml.info/
Supplementary literature	Scientific and popular papers in the field of deep machine learning.		
Quality assurance	Conversation with students, student evaluation using an anonymous survey, self-assessment.		
Other (in the opinion of the proponent)			

Subject name	Astroparticle Physics		
ID	PMP133	Study year	2.
Lecturer	doc. dr. sc. Ivana Weber	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 15, P: 0
Subject status	Elective	Online percentage	25%

Subject description

Subject goals	To teach students about the basic concept and techniques used in experimental astroparticle physics
Enrolment requirements	Acquired knowledge and understanding un the courses of: Nuclear physics and Introduction in elementary particle physics.
Learning outcomes	§ It is expected that students knew the following: § Understand the cosmic ray spectrum § Understand the accelerations mechanism of cosmic ray § Understand the various emission mechanism responsible for nonthermal electromagnetic radiation from space § Understand the various technique of cosmic rays and high energy photons § Understand the bases of neutrino astronom
Syllabus	1. Cosmic rays: spectrum and composition 2. Acceleration mechanisms. 3. Emission mechanisms: Thompson scattering and bremsstrahlung. 4. Synchrotron radiation and inverse Compton scattering. 5. Detection techniques of cosmic rays and high-energy gamma rays. 6. Sources of high-energy gamma ray: supernovae, pulsars and AGNs. 7. Neutrino astronomy. 8. The search for dark matter. 9. Review of relevant experiments in astroparticle physics
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Pohađati barem 70% predavanja i 70% vježbi.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums		Oral exam	1		
Written exam		Project	2		

Assessment and evaluation of student work	Project task: detailed study of the selected experiment and seminar presentation

Required literature

Title	Number of copies available	Availability on other medium
Malcom S. Longair: "High Energy Astrophysics", Cambride University Press, Third edition, 2012		yes
Donald Perkins: "Particle Astrophysics", Oxford University Press, Second edition, 2009.		yes
Trevor Weeks: "Very High Energy Gamma-Ray Astronomy", IOP Publishing, 2003.		yes
Authors: De Angelis, Alessandro, Pimenta, Mário; Introduction to Particle and Astroparticle Physics Multimessenger Astronomy and its Particle Physics Foundations		yes

Supplementary literature	Review articles

Quality assurance	Statistics of the exam outcomes, anonymous survey at the end lectures to get input from the students about the quality of lectures
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Astrophysics I</td></tr>
<tr><td>ID</td><td>PMP131</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Koraljka Mužić</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 0
E: 30
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>25%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">At the end of the course, students are expected to be able to know the basics of radiation transfer, the structure, formation and evolution of stars, especially nuclear reactions in their nuclei, and the formation of white dwarfs, neutron stars and black holes.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After mastering the material, the student is expected to know:
1. Radiative transfer: absorption, emission and scattering coefficients, black body radiation, radiation transmission equation;
2. Equations of state of stellar material: Maxwell's velocity distribution, Boltzmann's and Saha's equations;
3. Stellar structure models: basic equations (mass distribution, hydrostatic equilibrium, energy transfer equation), boundary conditions, virial theorem, time scales, polytropic model;
4. Evolution of stars: early evolution (formation of stars and arrival on the main sequence), discussion of the evolution of stars of various initial masses, evolution after the main sequence.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Macroscopic description of radiation: intensity, flow, energy density and radiation pressure;
2. Radiation transmission: absorption, emission and scattering coefficients, black body radiation, radiative transfer equation;
3. Spectral lines: formation of lines, influence of the temperature, motions and magnetic field in matter on the profiles of spectral lines;
4. Equation of state of stellar matter: Maxwell's velocity distribution, Boltzmann's and Saha's equations;
5. Nuclear reactions in stars: thermonuclear reactions (general discussion of energy and reaction rate), hydrogen fusion (pp-chain and CNO cycle);
6. Stellar structure models: basic equations (mass distribution, hydrostatic equilibrium, energy transfer equation), boundary conditions, virial theorem, time scales, polytropic model;
7. Observations of stars: absorption and emission lines, stellar spectra, absolute and apparent magnitude, distance determination, Hertzsprung-Russell diagram;
8. Evolution of stars: early evolution (formation of stars and arrival on the main sequence), discussion of the evolution of stars of various initial masses, evolution after the main sequence;
9. Stellar pulsations: observations, pulsation physics, modeling, non-radial pulsations, helioseismology;
10. Degenerate remnants of stars: degenerate matter, white dwarfs, neutron stars, pulsars;
11. Black holes;
12. Binary stars: close binary stars, cataclysmic variables.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attendance: at least 70% of the lectures and 70% of the exercise sessions.</td></tr>
</table>

<table>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td>0.6</td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>1.2</td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1.2</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation</td><td colspan="6">The final grade will constitute of:</td></tr>
</table>

of student work	(1) Written exam or tests (40%) (2) Oral exam (30%) (3) Seminar (20%) (4) Discussion of a selected science article (10%).
Required literature	**Title** / **Number of copies available** / **Availability on other medium** D. A. Ostlie and B. W. Carrol, “An Introduction to Modern Stellar Astrophysics”, Addison Wesley (1995)
Supplementary literature	R. Kippenhahn and A. Weigert, “Stellar Structure and Evolution”, Springer-Verlag, Study edition (August, 1994) C. J. Hansen, S. D Kawaler & V. Trimble, “Stellar Interiors – Physical Principles, Structure, and Evolution”, Springer (2004)
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="6">Astrophysics II</td></tr>
<tr><td>ID</td><td>PMP230</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Koraljka Mužić</td><td>Points value (ECTS)</td><td colspan="4">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">25%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">After completing the course, students will be introduced to the types and classification of galaxies, the basics of potential theory, stellar kinematics and dynamics of stellar systems, the structure of the Milky Way and the formation and evolution of galaxies.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6"></td></tr>
<tr><td>Learning outcomes</td><td colspan="6">After mastering the material, the student is expected to know:
1. Types and classification of galaxies and their composition.
2. Methods of measuring extragalactic distances, and evidence for the existence of dark matter in galaxies.
3. Fundamentals of theory of potentials, dynamics of stellar systems and stellar kinematics.
4. Structure, kinematics and dynamics of the Milky Way;
5. The origin and evolution of galaxies.</td></tr>
<tr><td>Syllabus</td><td colspan="6">1. Galaxies: classification and observations, composition of galaxies, stellar populations. 2. Tully-Fisher relation, Faber-Jackson relation, fundamental plane, Hubble law, methods for measuring the distance of galaxies, rotational curves and evidence for dark matter in galaxies.
3. Photometry and galaxy profiles, Sersic profile. Galaxy spectra.
4. Fundamentals of theory of potentials: spherical, flattened (axisymmetric) and triaxial systems. Fundamentals of stellar kinematics (orbits, integrals of motion, Jean's theorem, Boltzmann's and Jean's equations) and dynamics of stellar systems.
5. Milky Way: structure, kinematics and dynamics (detailed analysis), stellar populations. 6. The first stars, clusters of galaxies.
7. Active galaxies. Supermassive black holes.
8. Formation and evolution of galaxies: gravitational instability, hierarchical theory of structure formation, gas influence.</td></tr>
<tr><td>Teaching types</td><td colspan="2">☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="3">☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Attendance: at least 70% of the lectures and 70% of the exercise sessions.</td></tr>
</table>

Monitoring student work						
	Class attendance	2	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	0.5		
	Colloquiums	1	Oral exam	1.5		
	Written exam	1.0	Project			

Assessment and evaluation of student work

The final grade will constitute of:
(1) Written exam or tests (40%)
(2) Oral exam (30%)
(3) Seminar (20%)
(4) Discussion of a selected science article (10%).

Required literature

Title	Number of copies available	Availability on other medium
Binney & Tremaine, “Galactic Dynamics”, Princeton University Press, 1987		
P. Schneider, „Extragalactic Astronomy and Cosmology”, Springer (2015)		

Supplementary literature	1.Binney and Merrifield, "Galactic Astronomy", Princeton University Press, 1988 2.Sparke and Gallagher, "Galaxies in the Universe", Cambridge University Press 3.Binney & Tremaine, “Galactic Dynamics”, Princeton University Press (1987).
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="6">Beskralježnjaci</td></tr>
<tr><td>ID</td><td>PMB025</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Biljana Apostolska</td><td>Points value (ECTS)</td><td colspan="4">6.5</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>45</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">10%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Usvajanje znanja i koncepata koji su bitni za razumijevanje morfologije, sistematike, filogenije i evolucije beskralješnjaka. Studenti će također biti osposobljeni za prepoznavanje/determinaciju različitih skupine avertebrata. Poseban naglasak unutar svake skupine stavljen je na upoznavanje faune Hrvatske. Znanje stečeno na predavanjima omogućit će studentima lakše praćenje i razumijevanje ostalih biologijskih i drugih predmeta na višim godinama studija.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Nema uvjeta za upis.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Student će nakon položenog ispita moći:
1. definirati temeljne pojmove iz sistematike i taksonomije beskralježnjaka.
2. razlikovati predstavnike različitih koljena beskralježnjaka
3. uočiti različite prilagodbe kod kopnenih i vodenih beskralježnjaka na posebne uvjete staništa.
4. povezati anatomske prilagodbe povezane s načinom hranjenja (procjeđivači, usitnjivači, strugači, predatori) i sa stilom života (sjedilački, polusjedilački, pokretni).
5. povezati procese tagmatizacije kod Arthropoda s prelaskom „života“ iz vode na kopno. 5. prepoznati anatomske i morfološke značajke nametničkih beskralježnjaka.
6. povezivati anatomske i morfološke značajke beskralježnjaka s njihovim položajem u trofičkim nivoima svih tipova ekosustava.
7. služiti se samostalno ključevima za determinaciju beskralježnjaka svih tipova ekosustava.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Predavanja
1. Pregled svih skupina beskralješnjaka od Protista do Echinodermata uz usvajanje osnovnih embrioloških pojmova i pojmova vezanih uz sistematiku beskralješnjaka. (3)
2. Protista, osnovni princip građe tijela, organeli i životne funkcije, sistematika, pregled najznačajnijih vrsta. (3)
3. Spongia-spužve - osnovni princip građe tijela, vrste stanica i njihova uloga, sistematika, pregled najznačajnijih vrsta. (3)
4. Platodes i Aschelminthes - osnovni princip građe tijela, vrste organa i njihova uloga, sistematika, pregled najznačajnijih vrsta. (3)
5. Mollusca - pregled po skupinama, osnovni princip građe tijela, vrste organa i njihova uloga, sistematika, pregled najznačajnijih vrsta. (3)
6. Annelida - pregled po skupinama, osnovni princip građe tijela, vrste organa i njihova uloga, sistematika, pregled najznačajnijih vrsta. (3)
7. Arthropoda - Arachnida, Myriapoda - pregled po skupinama, osnovni princip građe tijela, vrste organa i njihova uloga, sistematika, preglednajznačajnijih vrsta. (3)
8. Arthropoda - Crustacea - pregled po skupinama, osnovni princip građe tijela, vrste organa i njihova uloga, sistematika, pregled najznačajnijih vrsta. (3)
9. Arthropoda - Insecta - pregled po skupinama, osnovni princip građe tijela, vrste organa i njihova uloga, sistematika, pregled najznačajnijih vrsta. (3)
10. Echinodermata - pregled po skupinama, osnovni princip građe tijela, vrste organa i njihova uloga, sistematika, pregled najznačajnijih vrsta. (3)
Vježbe
1. Protista I; (3 sata)
2. Protista II; (3)
3. Spongia; (3)
4. Platodes; (3)
5. Aschelminthes; (3)
6. Mollusca-Gastropoda; (3)
7. Mollusca - Bivalvia; (3)
8. Mollusca - Cephalopoda; (3)
9. Annelida; (3)
10. Crustacea; (3)
11. Insecta I; (3)
12. Insecta II; (3)</td></tr>
</table>

<table>
<tr><td></td><td>13. Echinodermata I; (3)
14. Echinodermata II; (3)
15. Pregled endemične faune Hrvatske (3)</td></tr>
<tr><td>Teaching types</td><td><table><tr><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☑ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☑ Izrada zbirke beskralježaka
☐
☐
☐</td></tr></table></td></tr>
<tr><td>Student obligations</td><td>prema Pravilniku o studiranju</td></tr>
<tr><td>Monitoring student work</td><td><table>
<tr><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Izrada zbirke beskralježaka</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>4</td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td>Ispit se sastoji od pismenog i usmenog dijela. Gradivo predmeta podijeljeno je na dvije cjeline koje studenti polažu preko parcijalnih pismenih ispita ili pak pristupanjem cjelokupnom ispitu na kraju semestra. Pismeni ispit se smatra položenim ukoliko studenti postignu najmanje 60% od ukupnog broja bodova. Nakon položenog pismenog dijela student stiče pravo izlaska na usmeni dio ispita. Konačna ocjena formira se temeljem ocjena iz pismenog i usmenog dijela ispita. Bodovanje: <60% student nije zadovoljio; 60-70% dovoljan (2); 70-80% dobar (3); 80-90% vrlo dobar (4); 90-100% izvrstan (5)</td></tr>
<tr><td>Required literature</td><td><table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>Matoničkin, I. Biologija viših avertebrata, Školska knjiga, Zagreb, 1999</td><td></td><td></td></tr>
<tr><td>Matoničkin, I, Habdija, I. i Habdija-Primc, B. Biologija nižih avertebrata, Školska knjiga, zagreb, 1998</td><td></td><td></td></tr>
<tr><td>Habdija, I. i sur. (2011). Protista-Protozoa - Metazoa-Invertebrata strukture i funkcije. Alfa, Zagreb.</td><td></td><td></td></tr>
<tr><td>Habdija, I. i sur. (2004). Protista-Protozoa i Metazoa-Invertebrata. Funkcionalna građa i praktikum. Meridijani, Samobor.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td>Miller, S.A., Harley, J.P. (2004): Zoology. McGraw-Hill, Boston. Hickman, C. Jr., Roberts, L., Larson, A., I'Anson, H. (2003): Integrated Principles of Zoology.McGraw-Hill, Boston. Wheater's Functional Histology: a text and colour atlas, ed. B. Young, J.W. Heath, Churchill Livingstone, London, 2001 Ruppert, E.E., R. S. Fox and R. D. Barnes (2004). Invertebrate Zoology. A functional evolutionary approach. Seventh edition, Thomson Brooks/Cole.</td></tr>
<tr><td>Quality assurance</td><td>Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td></td></tr>
</table>

Subject name	Biophysics		
ID	PMP141	Study year	1.
Lecturer	izv. prof. dr. sc. Larisa Zoranić	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 15, P: 0
Subject status	Elective	Online percentage	10%

Subject description

Subject goals	Basic understanding of protein structure and function applying the physical principles and models, starting from the description of the conformational changes and molecular interactions in biological macro-molecules, towards more complex systems and their role in cellular processes.
Enrolment requirements	Basic knowledge in molecular biology, biochemistry, classical mechanics, electrodynamics and statistical mechanics.
Learning outcomes	On completion of this course a student should be able to: 1. Ability to recognize and articulate the foundational assumptions and main ideas of simple and some of the more advanced physical models that describe structure and function of proteins 2. Ability to recognize and articulate the foundational assumptions and main ideas of physical models that describe biological processes in some simple cases 3. Solve problems frequently encountered in biophysics in some simple cases 4. Develop a critical understanding of scientific investigation in biophysics and ability to describe and present such research
Syllabus	1. Introduction, molecular forces in biological structures 2. Biological macromolecule. Models in biology 3. Cells and structures with them. Hemoglobin as a model protein 4. Mechanical and chemical equilibrium. Configurational energy. Structures as free-energy minimizers 5. Statistical mechanics approach. Equlibrium constants 6. Ligand-Receptor Binding. The Hill Function 7. Two-State Systems: Global transitions in proteins 8. Molecular associations. Allosteric interactions 9. Structure of macromolecules. Mechanical properties. 10. Macromolecules as random walks and as a rigid body 11. Modelling of the protein structure 12. Electrical signals in cell. Ion permeation and membrane potential. 13. Transport processes across membrane. Action potentials. 14. Diffusion 15. Chemical kinetics
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Active participation in classes and assignments. Solving given physics problem for seminar and its presentation.

Monitoring student work

Class attendance	2	Research		Practical work	1
Experimental work		Paper			
Essay		Seminar paper	2		
Colloquiums		Oral exam			
Written exam	1	Project			

Assessment and evaluation of student work	The conditions for passing the exam are: passed colloquium or written exams, written and presented assignments related to specific topics, written and held seminar. The grade is concluded according to the evaluation of the student's commitment in class, the grade of the written part and the grade of the seminar.

Required literature

Title	Number of copies available	Availability on other medium

	Physical Biology of the Cell, Rob Phillips, Jane Kondev, Julie Theriot and Hernan G. Garcia, Garland Science, Taylor & Francis Group, 2013.	1	online
Supplementary literature	1. Molecular and Cellular Biophysics Meyer B. Jackson University of Wisconsin Medical School, Cambridge University Press 2006 . 2. Bioenergetika, rad membranskih proteina Juretić Davor, Informator, Zagreb, 1997. 3. Glaser, R. "Biophysics". Springer-Verlag, Berlin, 2001. 4. Fersht, A. "Structure and mechanism in protein science", Freeman and Company, New York, 1998. 5. Volkenshtein, M.V. "Biophysics", Mir Publishers, Moscow 1983. 6. Hill, T.L. Free "Energy Transduction in Biology", Academic Press, New York 1977. 7. Molekularna biofizika , Antonio Šiber , skripta, 2012. 8. Scientific articles		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Biophysics of Biological Membranes</td></tr>
<tr><td>ID</td><td>PMP213</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Marija Raguž</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 5, E: 25, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Introduction to the structure and dynamics of biological membranes through physical concepts and available experimental methods, and data analysis applied to these systems.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After successfully completing the course, students will be able to:
1. Identify and define the membrane system with description of structure and dynamics.
2. Understand and apply selected biophysical experimental methods for styding biological systems.
3. Explain and evaluate basics of physical models that describe biological membranes.
4. Analyze, explain and present the results of spectroscopic methods applied to the biological membrane system.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Lectures and seminars:
(4P) Description, structure and dynamics of biological membranes
(3P) Formation of biological membranes
(2P) Phase transitions in the described systems
(4P + 1S) Electron parametric resonance
(4P) Nuclear magnetic resonance
(4P + 1S) Fluorescence spectroscopy
(4P + 1S) Fluorescence microscopy
(3P) Calorimetry
Exercises:
1. Methods of preparation of biological systems:
(2V) Preparation of multilamellar liposomes
(4V) Electroformation of giant unilamellar vesicles
(2V) Extrusion of large unilamellar vesicles
(2V) Preparation of small unilamellar vesicles
(3V) Methods of preparation of supported membrane bilayer using small, large and giant unilamellar vesicles
2. Experimental investigations of structure and dynamics of biological membranes:
(3V) Fluorescence microscopy
(3V) Fluorescence spectroscopy
(3V) Electron microscopy
(3V) Atomic force microscopy Elective topics
(2P+2S): Electron microscopy
Atomic force microscopy
X-ray diffraction</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☑ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Active participation in classes and assignments. Work on the experimental devices.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 2; Research: ; Practical work:
Experimental work: 2; Paper: ; Experimental work: 1
Essay: 1; Seminar paper:
Colloquiums: ; Oral exam:
Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Students have an oral exam, which can be replaced by the presentation of the specific topic.</td></tr>
</table>

Required literature	Title	Number of copies available	Availability on other medium
	Scientific articles		
Supplementary literature	M. Furić, Moderne eksperimentalne metode, tehnike i mjerenja u fizici, Školska knjiga, Zagreb, 1992. R. A. Dunlap, Experimental Physics – Modern Methods, Oxford University Press, New York, 1988.		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

Subject name	Biophysics of Hearing and Speech						
ID	PMP247	Study year	1.				
Lecturer	izv. prof. dr. sc. Damir Kovačić	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			35	5	10	0	
Subject status	Compulsory	Online percentage	20%				

Subject description	
Subject goals	To familiarize students with: – fundamental concepts of biophysical mechanisms of hearing and speech production; – research methods in the field of biophysics of hearing and speech.
Enrolment requirements	Enrolled one of the diploma study programs. Passed exam in General Physics III (waves).
Learning outcomes	1. To define the physical parameters of sound and speech as a special sound categories. 2. To describe the properties of simple and complex sounds. 3. To explain the spectral analysis of sounds and speech. 4. To describe the main elements of the auditory system. 5. To understand the main processes responsible for the neural basis of listening. 6. To list research methods in the field of biophysics of hearing and speech. 7. To link research methods with the scientific and research issues.
Syllabus	Lecture (6h): Acoustics Lecture (6h): Physiology of hearing Lecture (6h): Peripheral and central auditory system Lecture (6h): Auditory perception and production of speech Lecture (6h): Research methods of hearing and speech Seminar (2h): Methods for recording and reproduction of acoustic and speech stimuli Seminar (2h): Biophysical models of cochlear mechanics Seminar (1 h): Neuroengineering and new technologies in hearing and speech (cochlear implants) Exercises (2h): Spectral analysis of sound and speech Exercises (2h): Speech audiometry Exercises (2h): Biophysical techniques of recording neuronal activity of auditory cells and auditory neurons Exercises (2h): Demonstration of the cochlear implant Exercises (2h): Demonstration of 3D navigation transcranial magnetic stimulation
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	The student is required to attend lectures, seminars and exercises, with a maximum of 20% of excused absences. The student has to pass thecolloquium. After passing the colloquium, the student is required to write a term paper with the chosen topic and present it in the form of presentation to colleagues and teacher.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	2		
Colloquiums	2	Oral exam			
Written exam		Project			

Assessment and evaluation of student work	The grade is determined based on: – Colloquium (25% grade) – Seminar paper (50% grade) – Oral presentation (25% grade)

Required literature

Title	Number of copies available	Availability on other medium

	William Yost: Fundamentals of Hearing Science		
Supplementary literature	Brian C. J. Moore: An introduction to the psychology of hearing Jan Schnupp, Israel Nelken & Andrew King: Auditory Neuroscience - Making Sense of Sound		
	James O. Pickles: An introduction to the physiology of hearing Daniel J. DiLorenzo and Joseph D. Bronzino: Neuroengineering Izabrani znanstveni članci		
Quality assurance	1. Evaluation of results in accordance with the determined learning outcomes. 2. Feedback from students via surveys. Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split. 3. Self-evaluation of teacher 4. Institutional and non-institutional checks		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Bioinformatics</td></tr>
<tr><td>ID</td><td>PMP140</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Željka Sanader Maršić</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The aim of the course is to introduce students with available tools used in bioinformatics for the analysis of sequences and protein structures and nucleic acids.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">The learning outcomes of Bachelor programmes in physics, basic knowledge in molecular biology and biochemistry. For successful following of the bioinformatics course, it is necessary to have fundamental knowledge of biochemistry and biophysics. Specifically, it is necessary to know the structure and physico-chemical properties of the nucleotides and amino acids as covered by the previous college courses.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">On completion of this course a student should be able to:
1. use tools for comparing nucleic acid sequences
2. use tools for comparing protein sequences
3. use tools for predicting the protein structure
4. select tools according to the needs of the analysis
5. interpret results obtained using bioinformatic tools</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Introduction to bioinformatics, familiarity with the history and development of bioinformatics
2. Database knowledge (NCBI), database of gene and protein sequences (NCBI, SWISSPROT, UNIPROT, CATH, SCOP), protein structures (PDBs), functional domains of proteins (PFAMs) and complete genomes (ENSEMBL)
3. Aligning Nucleic Acid and Protein Sequence Tools: TCOFFEE, MCOFFEE, Clustal
4. Prediction of secondary and tertiary structure of proteins: modeling by homology and tools used for said prediction (PSI-PRED, Modeller, Phyre, Threader)
5. Protein structure visualization programs
6. Introduction to Molecular Dynamics of Proteins
7. Prediction of the secondary and tertiary structure of nucleic acids</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Active participation in classes and assignments. Solving given problems, writing and presenting seminars.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1; Research: 2; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper: 1
Colloquiums: ; Oral exam: 2
Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Evaluation of attendance of seminars and oral exam.</td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
Arthur Lesk: Introduction to Bioinformatics | | da
Charles Cantor: Biophysical Chemistry Part I, The Conformation of biological Macromolecules | | da</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Des Higgins and Willie Taylor's "Bioinformatics: Sequence Structure and Databanks, Scientific articles</td></tr>
<tr><td></td><td colspan="3"></td></tr>
</table>

Quality assurance	1. Analysis of the acquired learning outcomes at the end of the class, compared with the introductory work of students. 2. Monitoring the development of students in the subjects who followed the links with the success of the case 3. Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="6">Bioinformatics</td></tr>
<tr><td>ID</td><td>PPC211</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Stjepan Orhanović</td><td>Points value (ECTS)</td><td colspan="4">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>15</td><td>0</td><td>15</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">20%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Course objective is acquiring knowledge about experimentally generated data (sequences and structural information) in biochemistry and molecular biology, their deposition in the databases and their processing using bioinformatics tools.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Entry competences encompasses basic knowledge of the structure and the sequences of DNA and proteins.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Upon completing exam student will be able to:
1.perform search of relevant databases: scientific publications, sequences of nucleic acids and proteins, and structures of biological macromolecules
2.analyze protein, DNA and RNA sequences
3.analyze protein structure
4.recognize role and possibilities of bioinformatics in the drug development
5.recognize ways to analyze genomes and relationship of the gene sequence, phenotypes and inherited disease</td></tr>
<tr><td>Syllabus</td><td colspan="6">Lectures of bioinformatics are going to be followed by practical exercises in the informatics classroom and by presentation of student’s seminars.
1. Scientific literature and basis of scientific literature search I (lectures 1 hour, exercises 1 hour)
2. Scientific literature and basis of scientific literature search II (lectures 1 hour, exercises 1 hour)
3. Databases of nucleic acids sequences (lectures 1 hour, exercises 1 hour)
4. Databases of protein sequences (lectures 1 hour, exercises 1 hour)
5. Sequence alignment and phylogenetic threes I (lectures 1 hour, exercises 1 hour)
6. Sequence alignment and phylogenetic threes II (lectures 1 hour, exercises 1 hour)
7. Protein structure databases I (lectures 1 hour, exercises 1 hour)
8. Protein structure databases II (lectures 1 hour, exercises 1 hour)
9. Analysis of the protein structure (lectures 1 hour, exercises 1 hour)
10. Analysis of the protein structure II (lectures 1 hour, exercises 1 hour)
11. Databases of the sequenced genomes I (lectures 1 hour, exercises 1 hour)
12. Databases of the sequenced genomes II (lectures 1 hour, exercises 1 hour)
13. Structural bioinformatics and drug development (lectures 1 hour, exercises 1 hour)
14. Introduction to the DNA microarray data and use of mass spectrometry in protein sequencing I (lectures 1 hour, exercises 1 hour)
15. Introduction to the DNA microarray data and use of mass spectrometry in protein sequencing II (lectures 1 hour, exercises 1 hour)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☑ Combined online</td><td colspan="2">☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="3">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Attending classes (Skipping 20 % lectures, seminars and exercises is allowed), preparing two seminars on selected topic.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td colspan="6">
<table>
<tr><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Students take written exam, passing grade on the written exams is set at 50 % of total points. Written part of the exam comprises 50 % of overall grade while seminar essays comprise another 50 %.</td></tr>
</table>

<table>
<tr><td rowspan="2">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Arthur M. Lesk, Introduction to bioinformatics 3e, Oxford University Press, 2008.</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">David W. Mount, Bioinformatics, Sequence and Genome analysis, 2e, Cold Spring Harbor Laboratory Press, 2004.
Jonathan Pevsner, Bioinformatics and Functional Genomics, John Wiley and Sons, 2009.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Personal consultations, completing partial exams, students survey for the evaluation of the subject and teacher, evidence of the presence on the classes, analysis of the success rate on the final tests.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Biochemistry I</td></tr>
<tr><td>ID</td><td>PMC103</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Viljemka Bučević Popović
izv. prof. dr. sc. Matilda Šprung</td><td>Points value (ECTS)</td><td>6.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The objective of the course is to gain knowledge about molecular basis of life.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">The course enrolment prerequisites are Organic Chemistry I and Organic Chemistry II.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After completing the course, the student will be able to:
1. State the properties of water and explain its significance for life processes.
2. Identify basic biomolecules and their building blocks.
3. Apply the principles of bioenergetics and thermodynamics to living organisms. 4. Explain the relationship between protein structure and function.
5. Describe the structure of the membrane and show the transfer of water, ions, organic molecules and gases across the membrane.
6. Explain the process of gas exchange with reference to the role of hemoglobin and myoglobin.
7. Interpret the mechanisms of control of enzyme activity with emphasis on hormonal regulation.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Lectures
1. Introduction to biochemistry (2 hours)
2. Molecular basis of life (2 hours)
3. Water properties (2 hours)
4. Thermodynamics of biological systems (2 hours)
5. Amino acids (2 hours)
6. Proteins (2 hours)
7. Posttranslational modifications (2 hours)
8. Secretory and transmembrane proteins (2 hours)
9. Lipids and biological membranes (2 hours)
10. Cell trafficking (2 hours)
11. Vitamins and cofactors (2 hours)
12. Enzymes (2 hours)
13. Hemoglobin, Myoglobin (2 hours)
14. Regulation of enzyme activity (2 hours)
15. Hormonal regulation of metabolism (2 hours)
Seminars follow lectures, with one lesson per topic.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attendance to at least 70% lectures and seminars.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>2.0</td><td>Oral exam</td><td>3.0</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Before each two-hour lecture, a quiz is held on the subject from the previous lecture. Student with score of more than 50% of total number of points, gets higher grade for corresponding partial exam (by one).
The written exam may be taken as two partial exams. At least 50% score is needed from each partial exam for passing grade on the written exam, followed by an oral exam.</td></tr>
<tr><td>Required literature</td><td></td><td>Number</td><td></td></tr>
</table>

	Title	of copies available	Availability on other medium
	Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Biokemija, 6th Ed., 2013, Školska knjiga, Zagreb		
Supplementary literature	Robert K. Murray, David A Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil, Harperova ilustrirana biokemija, 2010, Medicinska Naklada Zagreb Donald Voet, Judith G. Voet, Charlotte W. Pratt, Fundamentals of Biochemistry, 3rd Ed., 2005, John Wiley & Sons, Inc. Matilda Šprung, Biochemistry I, powerpoint lectures		
Quality assurance	Consultations, partial examinations, student survey for subject and teacher evaluation, attendance records, quiz performance analysis, partial and final exams.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Biochemistry II</td></tr>
<tr><td>ID</td><td>PMC106</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Viljemka Bučević Popović
izv. prof. dr. sc. Matilda Šprung</td><td>Points value (ECTS)</td><td>6.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The objective of the course is to gain understanding of basic metabolic processes.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">The course enrolment prerequisites are Organic Chemistry I and Organic Chemistry II.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After completing the course, the student will be able to:
1. Demonstrate understanding of fundamental catabolic processes.
2. Show understanding of basic anabolic processes.
3. Explain the mechanisms of regulation of metabolic processes.
4. Explain the mechanisms of storage and immobilization of fuel molecules.
5. Integrate metabolic processes at the organs level.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Lectures:
1. Introduction to metabolism (2 hours)
2. Glycolysis (2 hours)
3. Citric acid cycle (2 hours)
4. Respiratory chain (2 hours)
5. Oxidative phosphorylation, thermogenesis, oxidative stress (2 hours)
6. Gluconeogenesis (2 hours)
7. Pentose phosphate pathway (2 hours)
8. Glycogen metabolism and glycogen metabolism regulation (2 hours)
9. Degradation of fats and fatty acids, synthesis of ketone bodies (2 hours)
10. Synthesis of fatty acids, triacylglycerol synthesis and storage (2 hours)
11. Cholesterol (2 hours)
12. Amino acid metabolism (2 hours)
13. Hem (2 hours)
14. Nucleotide metabolism (2 hours)
15. Integration of Metabolism (2 hours)
Seminars follow lectures, with one lesson per topic.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attendance to at least 70% lectures and seminars.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance 1.5 | Research | Practical work
Experimental work | Paper |
Essay | Seminar paper |
Colloquiums 2.0 | Oral exam 3.0 |
Written exam | Project |</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Before each two-hour lecture, a quiz is held on the subject from the previous lecture. Student with score of more than 50% of total number of points, gets higher grade for corresponding partial exam (by one).
The written exam may be taken as two partial exams. At least 50% score is needed from each partial exam for passing grade on the written exam, followed by an oral exam.</td></tr>
<tr><td>Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td></td><td>Jeremy M. Berg, John L. Tymoczko, Lubert Stryer,</td><td></td><td></td></tr>
</table>

	Biokemija, 6th Ed., 2013, Školska knjiga, Zagreb
Supplementary literature	Robert K. Murray, David A Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil, Harperova ilustrirana biokemija, 2010, Donald Voet, Judith G. Voet, Charlotte W. Pratt, Fundamentals of Biochemistry, 3rd Ed., 2005, John Wiley & Sons, Inc.
Quality assurance	Consultations, partial examinations, student survey for subject and teacher evaluation, attendance records, quiz performance analysis, partial and final exams.
Other (in the opinion of the proponent)	

Subject name	Biochemistry II		
ID	PMC225	Study year	3.
Lecturer	doc. dr. sc. Viljemka Bučević Popović izv. prof. dr. sc. Matilda Šprung	Points value (ECTS)	6.5
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 45, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description

Subject goals	
Enrolment requirements	
Learning outcomes	
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☑ Multimedia ☑ Laboratory ☐ Mentoring
Student obligations	

Monitoring student work

Class attendance	3.0	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	0.5	Oral exam	1.5		
Written exam	1.5	Project			

Assessment and evaluation of student work	Mogućnost polaganja pismenog dijela ispita kroz dva djelomična ispita tijekom semestra. Za prolaznu ocjenu potrebno je riješiti 50 % svakog djelomičnog ispita. Prolazna ocjena na pismenom ispitu uvjet je za polaganje usmenog dijela ispita.

Required literature

Title	Number of copies available	Availability on other medium
Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Biokemija, 6th Ed., 2013, Školska knjiga, Zagreb		

Supplementary literature	Robert K. Murray, David A Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil, Harperova ilustrirana biokemija, 2010, Medicinska Naklada Zagreb Donald Voet, Judith G. Voet, Charlotte W. Pratt, Fundamentals of Biochemistry, 3rd Ed., 2005, John Wiley & Sons, Inc.
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	Konzultacije, parcijalni ispiti, studentska anketa radi evaluacije predmeta i nastavnika, evidencija o nazočnosti na predavanjima, analiza uspješnosti polaganja kolokvija, djelomičnih i završnih ispita.

Subject name	Biological Evolution		
ID	PMB519	Study year	3.
Lecturer	prof. dr. sc. Jasna Puizina	Points value (ECTS)	3.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 0, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description

Subject goals	
Enrolment requirements	
Learning outcomes	
Teaching types	☑ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	

Monitoring student work

Class attendance	1.5	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam	1.5		
Written exam		Project			

Assessment and evaluation of student work

Ispit je pismeni, a može se položiti i tijekom nastave kroz dva kolokvija.
Način vrednovanja ukupno prikupljenih bodova (max = 100):

90% – 100% ocjena 5 (izvrstan)
80% – 90% ocjena 4 (vrlo dobar)
65% – 80% ocjena 3 (dobar)
55% – 65% ocjena 2 (dovoljan)
< 55% ocjena 1 (nedovoljan).

Provjera znanja gradiva vrši se putem pismenog ispita koji se sastoji od zadataka na zaokruživanje, nadopunjavanje, opisivanje i označavanje na slici, te triju esejskih pitanja. Redovan rad tijekom semestra se vrednuje omogućavanjem polaganja ispita u vidu dva parcijalna kolokvija tijekom izvođenja nastave. Studentima se tijekom semestra nudi mogućnost osvajanja dodatnih bodova (max. 5%) putem kratkih kvizova, te bodovanjem usmenih odgovora na postavljenja pitanja tijekom predavanja i rješavanja domaćih uradaka. Student je dužan riješiti minimalno 55% ispita. Stopostotno pohađanje vježbi će se nagraditi s 2% na ispitu.

Required literature

Title	Number of copies available	Availability on other medium
Puizina, J. 2015: Evolucija – web nastavni materijali.		

Supplementary literature

http://evolbiol.ru/docs/docs/large_files/why_evolution_is_true.pdf
http://www.blackwellpublishing.com/ridley (Mark Ridley, Evolution, 3rd ed)
http://evolution.berkeley.edu/evolibrary/article/evo_01

Mirjana Kalafatić, 1998: Osnove biološke evolucije, Zagreb
Richard Dawkins: Najveća predstava na Zemlji, Izvori, 2008
Richard Dawkins: Sebični gen. Izvori, 1997.
Matt Ridley: Genom. Izvori, 1997.
Brian Sykes: Sedam Evinih kćeri. Naklada Zadro. Zagreb 2002.
Brian Sykes: Adamovo prokletstvo – budućnost bez muškaraca, Algoritam, Zagreb, 2006.
Geoffrey Miller: Razum i razmnožavanje. Kako je izbor partnera oblikovao evoluciju ljudske naravi. Algoritam, Zagreb, 2007.

Quality assurance

Statistics of test results and student evaluation via anonymous questionnaires at the

	end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

Subject name	Biološka oceanografija						
ID	PMB513	Study year	2.				
Lecturer	doc. dr. sc. Antonela Paladin	Points value (ECTS)	4.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	15	0	0	
Subject status	Compulsory	Online percentage	10%				

Subject description

Subject goals	Cilj predmeta je upoznati studente s biologijom morskih organizama te njihovom ulogom u ekosustavu. Upoznati ih s nastankom života u morima, s naglaskom na važnosti pojedinih skupina u planktonskim i bentonskim zajednicama morskih ekosustava, prilagodbama organizama na različita staništa te utjecajem čovjeka.
Enrolment requirements	Nema preduvjeta.
Learning outcomes	Nakon uspješno završenog predmeta student će moći: Definirati i opisati temeljne pojmove biologije mora i oceanografije. Analizirati i razumjeti biotičke oceanske sustave i organizme koje ih nastanjuju. Analizirati načine nastanjivanja organizama u oceanskim ekosustavima. Povezati prilagodbe organizama i njihova staništa. Razumjeti biogeokemijske cikluse u moru. Analizirati oceanografiju i biologiju jadranskog i Sredozemnog mora.
Syllabus	1. Uvod u oceanografiju i biologiju mora. 2. Morsko dno. 3. Kemijski i fizički aspekti morske vode i svjetskih oceana. 4. Oceanske životne sredine obzirom na topografiju 5. Zonacija oceanskih životnih sredina obzirom na batimetriju. 6. Živi svijet u moru i zone naseljavanja. 7. Uloga morskih organizama u biogeokemijskim procesima. 8. Ekološki regulatori raspodjele morskih organizama u moru. 9. Struktura i uloga morskih ekosustava. 10. Estuariji i područje prskanja mora, koraljni grebeni. 11. Obalna mora i kontinentalna podina. 12. Organizmi otvorenog mora. 13. Život u morskim dubinama. 14. Opasnosti za oceanske ekosustave. 15. Oceanografija i biologija Jadranskog i Sredozemnog mora.
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	

Monitoring student work						
Class attendance	1	Research		Practical work		
Experimental work		Paper				
Essay		Seminar paper	1			
Colloquiums		Oral exam	1			
Written exam	1	Project				

Assessment and evaluation of student work	Ocjenjuje se pisani dio seminarskog rada (obrada teme i struktura rada; grafički i drugi prilozi; literatura), prezentacija seminarskog rada te pismeni i usmeni ispit.

Required literature

Title	Number of copies available	Availability on other medium
Karleskint, G., Turner, R., Small, J 2006. Introduction to Marine Biology. Thomson brooks/Cole		
Castro, P., Huber, M. E., 2005. Marine Biology. McGraw–Hill, New York.		
Miller, C. B., 2004. Biological oceanography. Blackwell, Oxford.		

Supplementary literature	Peres, J. M., Gamulin-Brida, H. 1973. Biološka oceanografija. Školska knjiga, Zagreb. Viličić, D. 2002. Fitoplankton Jadranskog mora. Školska knjiga Zagreb. Viličić, D. 2003. Fitoplankton u ekološkom sustavu mora. Školska knjiga Zagreb.
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Biološka raznolikost</td></tr>
<tr><td>ID</td><td>PMB540</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Mirko Ruščić</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3"></td></tr>
<tr><td>Enrolment requirements</td><td colspan="3"></td></tr>
<tr><td>Learning outcomes</td><td colspan="3"></td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3"></td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance; Research; Practical work; Experimental work; Paper; Essay; Seminar paper; Colloquiums; Oral exam; Written exam; Project</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3"></td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
–</td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3"></td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Biotechnology		
ID	PMC206	Study year	2.
Lecturer	doc. dr. sc. Viljemka Bučević Popović izv. prof. dr. sc. Matilda Šprung	Points value (ECTS)	2.5
Associates		Class execution (number of hours in semester)	L: 15, S: 0, E: 15, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description	
Subject goals	Getting acquainted with methods and application of modern biotechnology
Enrolment requirements	No requirements
Learning outcomes	After completing the course, the student will be able to: 1. Compare biotechnology processes with other production processes. 2. Discuss the main areas of application of modern biotechnology in agronomy, food and pharma industry, medicine etc. 3. Assess the importance of biotechnology products in everyday life (in food, medicine, etc.). 4. Discuss the benefits and potential risks of using biotechnology.
Syllabus	LECTURES: 1. Definition of biotechnology. History of biotechnology. 2. The first biotechnological products – beer, wine, bread. 3. Genetic engineering in biotechnology. 4. Production and purification of human proteins in heterologous systems. 5. Biotechnological processes. Bioreactor (fermenter). Upstream and downstream processes. 6. Enzymes as biotechnological products and their use in food, textile and other industries. 7. Biotechnological procedures for the production of amino acids, vitamins and antibiotics. 8. Methods for production of GM plants. GM plants available on the market (resistance to herbicides, insects or viruses). 9. The second and third generation of GM plants. Risks associated with GM plants. 10. Conventional medications vs. biotechnological drugs. Monoclonal antibodies – preparation and application. 11. Gene therapy and problems associated with gene therapy. Stem cells and their use in medicine. 12. Methods for transgenic animal production. Application of transgenic animals in biomedical research, agronomy and pharma industry. 13. Animal cloning. Human cloning – reproductive and therapeutic. 14. Application of biotechnology for DNA analysis in medicine and forensics. 15. Biotechnology and bioterrorism. Ethics in biotechnology. EXERCISES: 1. Heterologous expression of protein in E. coli. Growth media preparation, bacteria culture preparation, induction of protein expression. Cell biomass harvest. (4 hours) 2. Bacterial cell lysis, preparation of cell protein extracts. Purification of protein by chromatography on an FPLC apparatus. (4 hours) 3. Analysis of protein product by electrophoresis (SDS-PAGE). (4 hours) 4. DNA analysis by RFLP analysis. (3 hours)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Attending classes, written exam for practical, oral exam

Monitoring student work						
	Class attendance	1	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums	0.5	Oral exam	1		

	Written exam		Project			

Assessment and evaluation of student work	Written exam for practical – 20% Oral exam – 80%

Required literature	Title	Number of copies available	Availability on other medium
	Renneberg, Biotechnology for Beginners, Academic Press, 2008		
	Lectures as pdf files		

Supplementary literature	Thieman, Palladino, Introduction to Biotechnology, Pearson, 2014. Clark, Pazdernik, Biotechnology, Academic Press, 2012.
Quality assurance	Consultations, partial examinations, student survey for subject and teacher evaluation, attendance records, quiz performance analysis, partial and final exams.
Other (in the opinion of the proponent)	

Subject name	Citogenetičke analize kromosoma		
ID	PPB253	Study year	3.
Lecturer	doc. dr. sc. Ivica Šamanić	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 10, S: 5, E: 15, P: 0
Subject status	Elective	Online percentage	10%
Subject description			
Subject goals	Uvid u molekularne aspekte kromosoma, diobe kromosoma te organizacije interfazne jezgre. Upoznavanje s tehnikama klasične i molekularne citogenetike		
Enrolment requirements	Nema ih.		
Learning outcomes	Student će nakon položenog ispita moći: 1.omogućiti razumijevanje i povezivanje molekularnih podataka o DNA sekvencama s kromosomima i ekspresijom na razini tkiva i stanica 2.integrirati stečena znanja iz različitih kolegija (prvenstveno Biologije stanice, Genetike i Molekularne biologije) na proučavanje genoma na razini kromosoma i kromatina 3.objasniti važnost citogenetike u fundamentalnim istraživanjima kao i način primjene u medicini, agronomiji i biotehnologij 4.omogućiti studentima stjecanje potrebnog znanja i vještina izvođenja in situ hibridizacije kako bi bili osposobljeni za rad u laboratorijima koji zahtjevaju primjenu ove tehnike (npr. citogenetički laboratoriji u kliničkoj praksi) 5.na temelju stečenih znanja stvoriti osnovu za daljnje znanstveno (poslijediplomsko) usavršavanje		
Syllabus	Predavanja 1.Citogenetičke tehnike: Tehnike molekularne citogenetike; Fluorescentna hibridizacija in situ (FISH), Genomska hibridizacija in situ (GISH), Hibridizacija in situ na DNA niti (DIRVISH), In situ PCR, PRINS, Mikrodisekcija kromosoma, Sortiranje kromosoma protočnim citometrom. Tehnike klasične citogenetike; G, R, C-pruge za identifikaciju kromosoma. (2 sata) 2.Organizacija kromatina: Nukleosomna organizacija kromatina, Viši stupanj organizacije kromatina, Regulacija kromatinske strukture, Organizacija kromatina i genska ekspresija u eukariota. (2 sata) 3.Strukturna područja eukariotskih kromosoma: Građa i funkcija centromera, Građa i funkcija telomera, Telomere i stanično starenje. (2 sata) 4.Arhitektura interfazne jezgre: Distribucija i organizacija kromosoma, kromosomskih područja i gena unutar interfazne jezgre stanica u diobi odnosno diferenciranih stanica, Načini diferencijacije stanica. (2 sata) 5.Kromosomske aberacije: numeričke (poliploidija i aneuploidija) i strukturne (terminalne delecije, intersticijske delecije, prstenasti kromosom, izokromosom) aberacije kromosoma. (2 sata) Praktična nastava: 1.Mjerenje duljine telomera metodom fluorescencijske hibridizacije in situ s PNA sondom (Q-PNA-FISH) u primarnim stanicama fibroblasta iz kože i/ili iz stanica periferne krvi, primjena tehnika molekularne biologije u citogenetici (PCR, gel elektroforeza, imunofluorescenicija), mikroskopiranje na svjetlosnom fluorescencijskom mirkoskopu, te obrada i analiza slike na računalu vezanom uz mikroskop. Seminar: 1.Dio nastave uključuje seminar. Studenti sami obrađuju originalni znanstveni rad tematski vezan uz nastavne cjeline te javno prezentiraju svoj rad (uključuje prezentaciju u Power Point programu te diskusiju). Cilj je osposobiti studenta da jasno formulira te kratko i koncizno prezentira znanstvenu problematiku (15 minuta), integrira znanje stečeno tijekom trajanja kolegija kroz kritičko razmišljanje i zaključivanje tijekom diskusije na temu seminarskog rada.		
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☑ Combined online	☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☑ Laboratory ☐ Mentoring	
Student obligations	Obveze studenata/studentica su redovito pohađanje nastave (predavanja), izvođenje laboratorijskih vježbi i samostalna priprema materijala za seminare.		

<table>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td>0.5</td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1.0</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Ocjenjuje se pisani dio (obrada teme i struktura rada; grafički i drugi prilozi; literatura) i prezentacija seminarskog rada.</td></tr>
<tr><td rowspan="2">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">Cooper, G.M., Hausman, R.E., 2015: Stanica-molekularni pristup. Šesto izdanje, Medicinska naklada, Zagreb 2015.
2. Metode u molekularnoj biologiji, 2007. Andreja Abramovič Ristov (ur). Institut Ruđer Bošković.</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">1. Molecular Biology of the Gene, Watson JD,Baker TA, Bell SP, Gann A, Levine M, Losick R, Pearson Education Inc., Benjamin Cummings, 2004.
2. Practical in situ Hybridisation, Schwarcher T, Heslop Harrison P, Bios, Scientific Publisher Ltd. 2000.
3. Plant Cytogenetics, Singh RJ, CRC Press London, 2003.
4. Species Evolution: The Role of Chromsome Change, Max King, Cambridge University Press, 1995.
5. Non radioactive in situ hybridisation application manual, Boehringer Mannheim, 1996.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Detectors in High Energy Physics</td></tr>
<tr><td>ID</td><td>PMP235</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Toni Šćulac</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Understanding particle interactions and detectors. Getting familiar with different types of detectors for low and high energies, going to the highest energies at CERN. Analysing experimental data and possible uses in technology.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Students are expected to:
1. Explain particle interaction with detectors
2. Understand basics of statistical data analysis
3. Understand how different types of detectors work
4. Describe different trypes of electronics used for data recording, transmission and signal manipulation
5. Explain the process of building and maintaining detectors
6. Explain how CMS, ATLAS, CTA, and Ice cube detectors work</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Particle interaction with matter, Bethe-Bloch equation. Cherenkov radiation.
2. Energy loss for electron and positron. Electromagnteic showers. Bremsstrahlung.
3. Introduction to statistical analysis.
4. Introduction to detectors.
5. Ionisation detectors.
6. Scintilation detectors.
7. Photomultiplicators.
8. Interim exam.
9. Semiconductor detectors.
10. Signals and electronics.
11. Signal transmission.
12. Electronics for signal analysis.
13. CMS and ATLAS detectors.
14. MAGIC CTA detector.
15. Ice cube neutrino detector.</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attend at least 70% of lectures and 70% of exercises.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper: 1
Colloquiums: ; Oral exam: 1
Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Presence and activity during lectures. Student seminar presentation and oral exam.</td></tr>
<tr><td rowspan="3">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>William R. Leo Techniques for Nuclear and Particle Physics Experiments: A How - to Approach, Second Revised Edition Springer - Verlag Berlin Heidelberg, 1994.</td><td></td><td></td></tr>
<tr><td>Stefaan Tavernieri Experimental Techniques in Nuclear and Particle Physics Springer - Verlag Berlin Heidelberg, 2010.</td><td></td><td></td></tr>
</table>

Supplementary literature	Glenn F. Knoll Student Solutions Manual to accompany Radiation Detection and Measurement, 4th Edition J. Wiley & Sons, New York, 2012.
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Didactics		
ID	PMS105	Study year	1.
Lecturer	doc. dr. sc. Anna Alajbeg	Points value (ECTS)	3.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 0, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description

Subject goals	To recognize the complexity, multistructurality and multicausality of the educational process and realize the necessity of fostering a positive educational atmosphere as a prerequisite for success in educational work
Enrolment requirements	No.
Learning outcomes	1. To master basic didactic concepts 2. To train to detect the fundamental processes and principles that govern an educational work 3. To acquire a basis for planning, programming, preparation and performance of an educational work that will later be improved within the methodology of subjects 4. To gain awareness of the importance of the pedagogical atmosphere in educational work
Syllabus	*1.Didactic as a scientific discipline 2/3. The basic didactic processes 4.–6. Teaching – assumptions and aspects 7. Strategies, aims and tasks of education 8.–13. Educational technology: the organization and articulation of teaching; planning and programming; facilities, resources and media; didactic principles and systems; structures and dynamics of teaching; preparing and teaching 14/15. Educational ecology: the assumptions and factors
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Class attendance, preparation and presentation of the seminar paper, preliminary exams or an exam.

Monitoring student work

Class attendance	1.5	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	0.5		
Colloquiums		Oral exam	0.5		
Written exam	0.5	Project			

Assessment and evaluation of student work	Class attendance, activity, the results of preliminary exams, exam results.

Required literature

Title	Number of copies available	Availability on other medium
1. Poljak, V. (1991. i dalje): Didaktika. Školska knjiga, Zagreb.		
2. Bežen, A., Jelavić, F., Kujundžić, N., Pletenac, V. (1991. i dalje): Osnove didaktike. Školske novine, Zagreb.		
3. Bognar, L., Matijević, M. (2002. i dalje): Didaktika. Školska knjiga, Zagreb		

Supplementary literature	Meyer, H. (2002.): Didaktika razredne kvake. Educa, Zagreb. Desforges, Ch. (2001.): Uspješno učenje i poučavanje. Educa, Zagreb. Dryden, G., Vos J. (2001.): Revolucija u učenju. Educa, Zagreb. Jensen, E. (2003.): Super nastava. Educa, Zagreb**
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of

	Split
Other (in the opinion of the proponent)	* Contents are listed for academic block-hours (15 terms x 2 hours) ** Seminar papers are presented in seminar groups (15x1 per group)

Subject name	Differential equations		
ID	PMM950	Study year	2.
Lecturer	doc. dr. sc. Andrijana Ćurković	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	40%

Subject description	
Subject goals	To insure that chosen chapters of the subject comprise the most important ideas, results and methods from both viewpoints: theoretical and practical. Highlighting the analysis of second order equations, a balanced exposition should insure transition from memorized formulas to the critical understanding of the fundamental Existence and uniqueness theorem and its proof.
Enrolment requirements	Working knowledge of calculus, gained from a normal two- or three-semester course sequence or its equivalent. An acquaintance with functions of several variables, elementary complex functions and operations with matrices. In internal case: taken courses Mathematics 1 and Mathematics 2 (or DIR I).
Learning outcomes	Student should 1. be able to distinguish different types of first order DE and to apply methods for their solving; 2. understand what an initial value problem is, and how to show a given function is a solution to one; 3. recognize a homogeneous LDE with constant coefficients and be able to write down the fundamental solution set; 4. be able to find particular solutions of LDE through the method of undetermined coefficients and variation of parameters; 5. explain what happens to solutions as time tends to infinity; 6. make use of a known solution to reduce the order of HLDE; 7. find power series solutions of second order LDE; 8. use the Wronskian to show whether solutions are linearly independent; 9. be able to write down the solution to the problem x'=Ax, x(t0)=x0 by means of matrix exponential function; 10. explain in their own words conditions that ensure existence and uniqueness of a solution to the Cauchy problem.
Syllabus	1. The notion of DE. Basic mathematical models; direction fields. Classification of DE. (2 hours) 2. First order DE: linear, separable, homogeneous, Bernoulli, Riccati. (2 hours) 3. Differences between linear and nonlinear equations. Exact equations. Introduction to the second order LDE. (2 hours) 4. Algebraic structure of the solution set to homogeneous LDE. Abel's theorem. Linear independence and the Wronskian. (2 hours) 5. Second order homogeneous LDE with constant coefficients. Nonhomogeneous equations: method of undetermined coefficients. (2 hours) 6. Method of variation of parameters for second order LDE. General theory of nth order LDE. (2 hours) 7. LDE of nth o rder with constant coefficients. Nonhomogeneous LDE of nth order. (2 hours) 8. Series solutions of second order LDE near ordinary point. (2 hours) 9. Regular singular points. Euler equations. (2 hours) 10. Series solutions of second order LDE near regular singular point. (2 hours) 11. Bessel's equation. Systems of first order DEs. Systems of first order LDEs. (2 hours) 12. Homogeneous linear systems with constant coefficients. (2 hours) 13. The matrix exponential function. Nonhomogeneous linear systems. (2 hours) 14. Proof of the Existence and uniqueness theorem for one-dimensional problem. (2 hours) 15. Existence and uniqueness theorem for a n-dimensional problem; a glance on linear case. (1 hour)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ ☐

	☐ Fully online ☐ Combined online	☐ Laboratory ☐ Mentoring	☐ ☐
Student obligations	Attending lectures and exercises and taking exams.		

Monitoring student work	Class attendance	2	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam	2		
	Written exam	2	Project			

Assessment and evaluation of student work	During the semester students write two partial tests. Final exam consists of a written and an oral part due for completion within one exam term. Both parts are equally valued in the final grade. Passing written test (score ≥50%) is a necessary condition for taking up an oral exam. At the end of the semester, students who passed both partial tests are admitted directly to the oral exam in an exam term (January/February) of their choice.

Required literature	Title	Number of copies available	Availability on other medium
	W.E. Boyce and R.C. DiPrima, Elementary Differential Equations and Boundary Value Problems, John Wiley & Sons, Inc., New York, 2012		Elektronski dokument na Moodle podršci

Supplementary literature	1. M. Alić, Obične diferencijalne jednadžbe, skripta, PMF-Zagreb, Matematički odjel, 1994. 2. D.G. Zill and M.R. Cullen, Differential Equations with Boundary-Value Problems, Brooks/Cole, Cengage 2009.
Quality assurance	Exam results statistics. Students' quality assessment at the end of the semester carried out by the University authorized committee through anonymous polls.
Other (in the opinion of the proponent)	

Subject name	Differential and Integral Calculus I		
ID	PMM152	Study year	1.
Lecturer	prof. dr. sc. Milica Klaričić Bakula	Points value (ECTS)	8.5
Associates		Class execution (number of hours in semester)	L: 45, S: 0, E: 60, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description	
Subject goals	The aim of the course is to present differential and integral calculus of real-valued functions of single real variable and its application to various problems.
Enrolment requirements	Prerequisite course: Introduction to Mathematical Analysis
Learning outcomes	The student is able to: – distinguish and give examples of differentiable and nondifferentiable functions, integrable and non-integrable functions – apply techniques for computing derivatives of real functions, and definite and indefinite integrals of real functions – determine the intervals of monotonicity and convexity / concavity of a function and local extrema using differential calculus – apply differential and integral calculus to solve some geometric problems – identify conditions for the representation of a function as a power series – apply power series to solve some problems such as approximation of a definite integral.
Syllabus	Differential calculus (differentiability, derivatives of elementary functions, derivatives of higher orders, basic theorems of differential calculus, intervals of monotonicity and convexity/concavity, local extrema, applications) - 20 (ex. 25) Integral calculus (concept and basic properties of definite and indefinite integrals, the integration of certain classes of functions, basic theorems of integral calculus, applications of definite integrals, improper integrals, applications) - 20 (ex. 30) Power series (Taylor series, applications) - 5
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☑ Problem sets ☐ ☐ ☐
Student obligations	Active engagement in discussions during problem sessions and exercises. Doing homework regularly.

Monitoring student work

Class attendance	3	Research		Practical work	0.5
Experimental work		Paper		Problem sets	1
Essay		Seminar paper			
Colloquiums	2	Oral exam	2		
Written exam		Project			

Assessment and evaluation of student work

Problem solving during class for extra credit. Midterm written exams or final written exam and final oral exam. Passing the written exam is a prerequisite for the oral exam.

Continuous assessment		
Evaluation elements	Performance (min)	Weight in grade (%)
partial written exams	50	50
problem sets	0	5

	short tests	50	10

Final assessment		
Evaluation elements	Performance (min)	Weight in grade (%)
oral exam	50	35

Required literature	Title	Number of copies available	Availability on other medium
	G. B. Thomas, Thomas' Calculus, Pearson, 2016.,13. izdanje	2	e-learning
	B. Guljaš, Matematička analiza 1 i 2, skripta PMF -a u Zagrebu, 2018.	0	e-learning
	S. Abbott, Understanding analysis, Springer-Verlag, New York, 2016., drugo izdanje	2	e-learning

Supplementary literature	R. Larson, B. Edwards, Calculus, Cengage Learning, 2016., 11. izdanje J. Stewart, D. Clagg, S. Watson, Calculus, Early Transcendetals, Cengage Learning, 2021., 8. izdanje V. Matijević, Matematička analiza 1 i 2, skripta PMF -a u Splitu, 2020.
Quality assurance	During the semester, anonymous surveys will be administered to students to determine which concepts have been least understood thus far, which will help instructors to adapt the course. Statistics of exam results and student evaluation through anonymous questionnaires at the end of the course. The survey will be conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

Subject name	DIFFERENTIAL AND INTEGRAL CALCULUS II						
ID	PMM156	Study year	2.				
Lecturer	doc. dr. sc. Snježana Braić	Points value (ECTS)	9.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			45	0	60	0	
Subject status	Compulsory	Online percentage	20%				

Subject description	
Subject goals	Students will: – acquire a basic knowledge of n-dimensional Euclidean space Rn – acquire a knowledge about convergence of sequences in Euclidian space Rn – learn the definition of limit and continuity of real function of several real variables, (so-called scalar function) and vector functions – be introduced to concepts of partial derivative and directional derivative along a given vector, derivability and differentiability of scalar and vector functions – relate differentiability of scalar function of several variables with its partial derivatives and directional derivatives along a given vector – acquire knowledge of tangent planes, linear, differential and quadratic forms – learn to determine higher-order differentials of a function – apply higher-order differentials of a function to Taylor formula – learn basic theorems of differential calculus of functions f:Rm->Rn – learn to examine local, constrained and global extremal values of scalar functions via its differentials and partial derivatives – learn Riemann integral of real function of two variables over a rectangle and over a Jordan measurable set – learn fundamental theorems of integral calculus and compute double and triple integrals using various systems in plane and space – learn to calculate volume of solids, mass and the centre of gravity of three-dimensional solids – acquire basic knowledges about multiple integrals – acquire a basic knowledge of curves
Enrolment requirements	Course enrolment: Successfully completed courses Differential and integral calculus I, Introduction to math. Analysis and Linear algebra I
Learning outcomes	Upon successful completion of this course students will be able to: -describe metric and vector structure of n-dimensional Euclidean space -determine limit and accumulation points of sequences in Euclidean space -characterize basic notions of mathematical analysis via sequence convergence -compute limit point of given scalar or vector functions -examine (continuous) differentiability of vector and scalar functions of several variables

	– compute partial derivatives and examine derivability and differentiability of scalar functions – state, prove and apply theorems of differential calculus for scalar functions – define linear, differential and quadratic forms and calculate local, constrained and global extrema for functions of two variables – define Riemann integral of real function of two variables over a rectangle and J–measurable sets – state, prove and apply theorems of integral calculus for scalar functions – compute double and triple integrals and apply them when calculating volume, mass and the centre of gravity of the solid body – define the curve
Syllabus	– Scalar product, norm and metric on Euclidean space Rn (3)
	– Sequence in Rn (3) – Limit of scalar and vector function (3) – Continuity of scalar and vector function (3) – Partial derivative and directional derivatives along a given vector, linear and differential form (4) – Basic theorems of differential calculus (Schwarz' theorem, Mean value theorem, Theorem of implicit function) (4) – Differentiability of functions, Tangent plane (4) – Taylor's theorem for multivariate functions (1) – Local, constrained and global extrema for functions of several real variables (3) – Riemann integral of real functions of two variables over a rectangular (2) – Jordan measurable sets, sets of measure zero (2) – Lebesgue's criterion for Riemann integrability (2) – Basic theorems of integral calculus (Mean value theorem for integrals, Fubini's theorem, The change of variable theorem) (4) – Multiple integrals (2) – Curve (4)
Teaching types	[x] Lectures [ ] Seminars [x] Exercises [ ] Fully online [ ] Combined online [ ] Fieldwork [ ] Individual assignments [ ] Multimedia [ ] Laboratory [ ] Mentoring [ ] [ ] [ ] [ ]
Student obligations	Attending classes. Students are expected to be present at least 70% of classes.

Monitoring student work						
	Class attendance	3	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums	3	Oral exam	3		
	Written exam		Project			

Assessment and evaluation of student work	

	Two partial written exams or one final written exam and final oral exam are required. There are two partial written exams during a semester. Passing both partial exams or the final written exam enables students to take an oral exam. Once they successfully pass written exam, they are not obligated to take it again no matter of the issue of the oral exam. Final grade is derived as the arithmetic mean of scores in partial exams (or a written exam) and the oral exam.

Required literature	Title	Number of copies available	Availability on other medium
	S. Braić, Diferencijalni i integralni račun II, skripta PMF, Split		
	N.Koceić Bilan, Osnove matematičke analize I, PMF, Split		
	Š. Ungar, Matematička analiza u Rn, Tehnička knjiga, Zagreb, 2003.		

Supplementary literature	N. Uglešić, Matematička analiza II, Matematička anliza III, W. Rudin, Principles of Mathematical Analysis, Mc-Graw Hill, New York, 1964.
Quality assurance	Summarizing test results and conducting an anonymous student survey at the end of the course. The survey is conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Dynamical Systems in the Environment		
ID	PMP267	Study year	1.
Lecturer	doc. dr. sc. Žarko Kovač	Points value (ECTS)	4.0
Associates		Class execution (number of hours in semester)	L: 30, S: 20, E: 0, P: 0
Subject status	Elective	Online percentage	0%

Subject description	
Subject goals	– acquiring basic knowledge of dynamical systems and mathematical physics – provide knowledge on the use of differential equations in the description of physical systems, and extension of the methodology to the description of non-physical systems – get acquainted with the basics of the theory of deterministic chaos – provide basic knowledge of ecological, population and epidemiological modelling in relation to physical processes in the environment
Enrolment requirements	– Mathematical Methods of Physics 2 – differential equations – basic programming
Learning outcomes	1. Describe physical systems in the environment using differential equations. 2. Knowledge of the method of solving differential equations describing dynamical systems. 3. Perform linearization and stability analysis of systems. 4. Formulation of simple mathematical models of dynamic systems in the environment. 5. Introductory knowledge of ecological modelling. 6. Introductory knowledge of population modelling. 7. Introductory knowledge of epidemiological modelling.
Syllabus	1. Linear systems with examples from environmental physics (4h L, 10h S) 2. Nonlinear systems with examples from environmental physics (4h L, 10h S) 3. Linearization (2h) 4. System stability (2h) 5. Feedback (2h) 6. Phase space (2h) 7. Deterministic chaos (2h) 8. Ecological modelling (4h) 9. Population modelling (4h) 10. Epidemiological modelling (4h)
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring ☑ domaće zadaće ☐ ☐ ☐
Student obligations	Attend at least 70% of lectures and 70% of exercises.

Monitoring student work						
	Class attendance	1	Research		Practical work	1
	Experimental work		Paper		Domaće zadaće	1
	Essay		Seminar paper			
	Colloquiums		Oral exam	1		
	Written exam		Project			

Assessment and evaluation of student work	
	During the first 7 weeks of classes, students receive 5 homework assignments from the first 5 teaching units. These assignments are handed over at the end of the 8th week of classes. During the next 7 weeks of classes, students receive 5 new homework assignments from the next 5 teaching units. These assignments are handed over at the end of the 15th week of class. Students who submit assignments on time and achieve more than 50% of the possible points are exempted from writing the written part of the exam. Students who do not pass assignments or achieve less than 50% of the possible points must take a written exam. In the first 7 weeks of classes, the teacher holds seminars on specific models of dynamical systems and together with students solves more complex problems analytically and numerically. In the 8th week of classes, students choose a model of a dynamic system that they analyse analytically, and implement a numerical version of the model and conduct simulations. Students present the obtained simulations at the end of the semester.

<table>
<tr><td></td><td colspan="3">The final grade is formed on the basis of homework / exam (1/3 grade), simulation (1/3 grade) and answers to the oral exam (1/3 grade).</td></tr>
<tr><td rowspan="3">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Steven H. Strogatz Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering Perseus Books, 1994.</td><td></td><td>da</td></tr>
<tr><td>J. D. Murray Mathematical Biology: An Introduction Springer, 2002.</td><td></td><td>da</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Rudy Slingerland & Lee Kump
Mathematical Modeling of Earth's Dynamical Systems
Princeton University Press, 2011.

Eugene M. Izhikevich
Dynamical Systems in Neuroscience
MIT Press, 2007.

Edward Ott
Chaos in dynamical systems
Cambridge University Press, 1993.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Dynamics of Atoms in Gases and Liquids</td></tr>
<tr><td>ID</td><td>PMP270</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Bernarda Lovrinčević</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 15, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>15%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Basic understanding of the microscopic structure and dynamics of gaseous and liquid systems and their modeling using Monte Carlo and Molecular Dynamics simulations.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Basic knowledge in statistical mechanics, thermodynamics, classical mechanics, quantum physics and programming.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Basic understanding of the microscopic structure and dynamics of liquids according to the ideas of statistical fluid physics.
2. Knowledge of basic and some of the advanced algorithms for calculating structural and thermodynamic quantities
3. Ability to model molecular systems in gaseous and liquid state
4. Ability to develop simple computer programs for simulation and analysis of simulation results
5. Understanding of computer experiments
6. Ability to use software packages for molecular dynamics simulation and data visualization programs</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Introduction to the course: basics of computer simulations, theory-experiment relationship. Basics of working in Linux.
2. Statistical description of the system: ensembles, probability density in phase space, time averaging and averaging over ensemble, ergot hypothesis.
3. N-particle density and N-particle distribution functions, 2-particle distribution function, radial distribution function (RDF), virial equation.
4. Introduction to simulations of molecular dynamics: three steps of simulation (initiation, equilibration, production). Example: molecular dynamics of rigid spheres.
5. Maxwell-Boltzmann velocity distribution in a system of rigid spheres. Code development and analysis of results.
6. Dynamic quantities in molecular dynamics: velocity-velocity correlation, diffusion coefficient: Green-Kubo and Einstein derivative.
7. Autocorrelation speed function: code generation and analysis of results.
8. Introduction to Monte Carlo simulations: an example of the Lennard-Jones system. Use of program code and analysis of results.
9. Monte Carlo simulation of fluid with modified potential: analysis of results and comparison with Lennard-Jones fluid.
10. Molecular dynamics of Lennard-Jones fluids and analysis of program code results. 11. Basic integration algorithms in molecular dynamics: calculation of particle positions and velocities.
12. Force fields in molecular dynamics: intramolecular and intermolecular potentials.
13. Basics of using a software package for molecular dynamics simulations.
14. Simulations of simple systems - water in liquid state. Results analysis and visualization.
15. Simulations of complex systems - protein in water. Results analysis and visualization.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">1. Attendance and commitment of students in class and preparation of assignments in class.
2. Doing homework.
3. Preparation of a seminar paper that includes independent modeling and simulation by the method of molecular dynamics of the selected physical problem and analysis of results.
4. Writing reports and seminar presentations.</td></tr>
<tr><td>Monitoring student work</td><td>Class attendance: 1</td><td>Research: 1</td><td>Practical work: 1</td></tr>
</table>

<table>
<tr><td rowspan="4"></td><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Homework assignments</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">1. Written part of the seminar paper – 35%.
2. Presentation of the seminar paper – 35%.
3. Exercises – 30%.</td></tr>
<tr><td rowspan="2">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">1. J.-P. Hansen and I. R. McDonald, Theory of simple liquids, Academic Press, 2006.</td><td></td><td>yes</td></tr>
<tr><td>Supplementary literature</td><td colspan="6">1. P. Allen & D. Tildesley, Computer Simulation of Liquids, Clarendon, Press, Oxford, 1987. 2. J. M. Haile: Molecular dynamics simulation, John Wiley & Sons, New York, 1992. 3. K. Huang, Statistical Mechanics, Wiley, New York 1963. 4. Znanstveni članci
3. K. Huang, Statistical Mechanics, Wiley, New York 1963.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Exam results statistics and student evaluation through a survey conducted by the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="6">Diploma Thesis</td></tr>
<tr><td>ID</td><td>PMPMSC</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td></td><td>Points value (ECTS)</td><td colspan="4">30.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>0</td><td>10</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Developing the competence of scientific research or synthesis of the selected topic in physics.
Developing the competence of using relevant literature and exploring the selected topic.
Developing the competence of thesis preparation and scientific/professional reporting.
Preparing the original thesis, whose methodology and scientific contribution are suitable for establishing the student`s work competence and research in physics, under the direct supervision of the selected supervisor.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">The thesis is a compulsory course for every second-year graduate student.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. Select and analyze a modern physical problem that is not included in the standard graduate program.
2. Formulate goals, tasks and research questions relevant to the problem.
3. Know the authoritative sources of knowledge.
4. Research and analyze the scientific literature and place your own research in the context of already published results, with the ultimate goal of publishing the work in a professional or scientific journal.
5. Use experimental, theoretical or computational methods to investigate a physical problem and collect data.
6. Use computer programs and appropriate models for data analysis.
7. Present the problem, its analysis of the results and conclusions in the form of an oral presentation and in the form of a text, in the form of a professional or scientific paper.
8. Edit the text stylistically by applying the spelling and grammar rules of the standard language in spoken and written communication.
9. Use multiple presentation of data and concepts (tables, graphs of functions, charts, diagrams, drawings, photographs, schemes, pictures) and correctly cite the literature.
10. Create a correct, linguistically and terminologically coherent and consistent original diploma thesis, in accordance with the standards of the profession, in which the research results of the chosen problem are presented clearly and precisely.</td></tr>
<tr><td>Syllabus</td><td colspan="6">1. Research methodology.
2. Relevant bases and knowledge resources.
3. Exploration of literature.
4. Formation of the research topic and hypotheses.
5. Instruments and the design of the experiment.
6. Sampling and collection of data.
7. Analysis of the results.
8. Elements of written professional and scientific reports.
9. Presentation elements.
10. Presentation-related multimedia.
The student selects one of the provided topics in physics and analyses it under the supervision of his/her supervisor with the aim to prepare a graduate thesis. After the student has passed all of the prescribed exams at the graduate study programme, he/she may, upon the agreement with the supervisor, commence with the preparation of the graduate thesis (exploration of the relevant literature, formation of the main issue/hypothesis, execution of research, analysis of research results). After the supervisor has determined that the student had sufficiently covered and mastered the selected topic, the supervisor proposes two other members of the Panel and, upon the agreement with the student, schedules the date of the graduate thesis defence at least one week before the proposed date. The student presents the graduate thesis and the fundamental knowledge in physics before a panel composed of his/her supervisor and two other teachers.</td></tr>
<tr><td>Teaching types</td><td>☐ Lectures</td><td>☐ Fieldwork</td><td colspan="4"></td></tr>
</table>

	☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online	☐ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring	☐ ☐ ☐ ☐
Student obligations	Consultations with a mentor on a given topic, preparation of a thesis, planning and holding seminars and defending the thesis. Creation of a diploma thesis.		

Monitoring student work						
	Class attendance		Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project	30		

Assessment and evaluation of student work	The written thesis, the public presentation of the thesis topic, and the answers to questions related to the thesis topic and physics in general are evaluated.

Required literature	Title	Number of copies available	Availability on other medium
	Literature for the selected topic of the diploma thesis, as recommended by the mentor.		yes

Supplementary literature	Articles from the current contents of the selected topic.
Quality assurance	1. Interviews with the student pre- and post-graduation. 2. Student surveys.
Other (in the opinion of the proponent)	

Subject name	Diploma Thesis		
ID	PMPMSC	Study year	2.
Lecturer		Points value (ECTS)	18.0
Associates		Class execution (number of hours in semester)	L: 0, S: 10, E: 0, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description	
Subject goals	Developing the competence of scientific research or synthesis of the selected topic in physics. Developing the competence of using relevant literature and exploring the selected topic. Developing the competence of thesis preparation and scientific/professional reporting. Preparing the original thesis, whose methodology and scientific contribution are suitable for establishing the student`s work competence and research in physics, under the direct supervision of the selected supervisor.
Enrolment requirements	The thesis is a compulsory course for every second-year graduate student.
Learning outcomes	1. To analyse professional and scientific literature. 2. To analyse a topic in physics that is outside of the scope of the standard study programme. 3. To apply orthographic, grammatical, and syntactical rules of the standard language in spoken and written communication. 4. To apply research methodology. 5. To apply presentation skills. 6. To use a computer for analysing and illustrating experimental and/or theoretical results. 7. To present complex physics concepts in a clear and concise manner. 8. To demonstrate the skill of coherent and professional composition of a professional and scientific text in physics by using metalanguage. 9. To prepare a satisfactory, linguistically and terminologically consistent thesis in line with the professional standards by thoroughly analysing the selected topic and by clearly and precisely presenting the research results. 10. To orally present the selected concepts and topics in physics and systematically and concisely demonstrate the fundamental knowledge of the field.
Syllabus	1. Research methodology. 2. Relevant bases and knowledge resources. 3. Exploration of literature. 4. Formation of the research topic and hypotheses. 5. Instruments and the design of the experiment. 6. Sampling and collection of data. 7. Analysis of the results. 8. Elements of written professional and scientific reports. 9. Presentation elements. 10. Presentation-related multimedia. The student selects one of the provided topics in physics and analyses it under the supervision of his/her supervisor with the aim to prepare a graduate thesis. After the student has passed all of the prescribed exams at the graduate study programme, he/she may, upon the agreement with the supervisor, commence with the preparation of the graduate thesis (exploration of the relevant literature, formation of the main issue/hypothesis, execution of research, analysis of research results). After the supervisor has determined that the student had sufficiently covered and mastered the selected topic, the supervisor proposes two other members of the Panel and, upon the agreement with the student, schedules the date of the graduate thesis defence at least one week before the proposed date. The student presents the graduate thesis and the fundamental knowledge in physics before a panel composed of his/her supervisor and two other teachers.
Teaching types	☐ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring ☐ ☐ ☐ ☐

<table>
<tr><td>Student obligations</td><td colspan="6">Consultations with the supervisor regarding the selected topic, preparation of the thesis, planning and presentation of seminar papers and public defence of the thesis. Preparation of the thesis.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td>18</td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">The final assessment of the graduate thesis includes the evaluation of the written thesis, of the public presentation of the thesis and of the answers to the questions related to the graduate thesis topic and physics in general.</td></tr>
<tr><td rowspan="2">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">Literature related to the selected thesis topic as recommended by the supervisor.</td><td></td><td>yes</td></tr>
<tr><td>Supplementary literature</td><td colspan="6">Research papers covering the selected thesis topic from the current journals.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">1. Interviews with the student pre- and post-graduation.
2. Student surveys.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Diploma Thesis</td></tr>
<tr><td>ID</td><td>PMPMSC</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td></td><td>Points value (ECTS)</td><td>12.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 0, S: 30, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Independently process a given topic from physics education.
Use the given literature independently and research the given topic in the literature.
Write a paper and present it publicly.
Systematize and orally present the acquired knowledge.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">The master thesis is a compulsory for all second year students.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Demonstrate the skill of coherent and professional writing on the subject of physics.
2. Treat a physics topic (conceptually and at a sufficiently high level of scientific rigor) that is not included in the standard study program.
3. Create a professionally correct, linguistically and terminologically consistent and consistent paper in accordance with the standards of the profession, which fully covers the given topic and in which the results of the study of the given topic are clearly and precisely presented.
4. Orally present selected ideas, concepts and content and systematically and concisely demonstrate basic knowledge in physics.</td></tr>
<tr><td>Syllabus</td><td colspan="3">The student chooses one of the offered topics, which he processes with the help of a mentor with the aim of creating a diploma thesis.
The student systematizes the basic professional knowledge acquired during the course and prepares for their demonstration.
The student presents the contents of the chosen topic as well as the basic professional knowledge in front of a committee consisting of the mentor and two other teachers.</td></tr>
<tr><td>Teaching types</td><td colspan="3">☐ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☑ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Consultations with the supervisor regarding the selected topic, preparation of the thesis, planning and presentation of seminar papers and public defence of the thesis.
Preparation of the thesis.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: ; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper:
Colloquiums: ; Oral exam:
Written exam: ; Project: 12</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The final assessment of the graduate thesis includes the evaluation of the written thesis, of the public presentation of the thesis and of the answers to the questions related to the graduate thesis topic and physics in general.</td></tr>
<tr><td>Required literature</td><td colspan="3"><table><tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr><tr><td>Literature related to the selected thesis topic as recommended by the supervisor.</td><td></td><td>yes</td></tr></table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Research papers covering the selected thesis topic from the current journals.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">1. Interviews with the student pre- and post-graduation.
2. Student surveys.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Ekologija podzemnih staništa		
ID	PPB265	Study year	1.
Lecturer	prof. dr. sc. Biljana Apostolska	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 15, S: 15, E: 0, P: 0
Subject status	Elective	Online percentage	10%

Subject description

Subject goals	Usvajanje znanja o osnovnim tipovima podzemnih staništa uz abiotičke i biotičke čimbenike svakoga od njih te upoznati faunu endema i relikata koju nalazimo na tim staništima. Poseban naglasak je na zakonskoj regulativi zaštite ovih staništa u Hrvatskoj
Enrolment requirements	Nema uvjeta za upis.
Learning outcomes	Student će nakon položenog ispita moći: 1.prepoznati osnovne tipove podzemnih staništa 2.naučiti osnovne krške oblike 3.objasniti i razumjeti abiotičke i biotičke parametre na navedenim staništima 4.prepoznati endeme i relikte faune podzemnih staništa 5.upoznati zakonsku regulativu vezanu uz zaštitu krša
Syllabus	Predavanja i seminari 1.Dinarski krš i njegovo rasprostranjenje u Hrvatskoj i u svijetu s osnovnim ekološkim značajkama (2P+2S) 2.Tipovi krških staništa (2P+2S) 3.Abiotički i biotički parametri na navedenim staništima (2P+2S) 4.Podjela organizama u podzemlju u njihove osnovne značajke (2P+2S) 5.Fauna podzemnih staništa (2P+2S) 6.Endemi i relikti (1P+1S) 7.Speleološki objekti (2P+2S) 8.Zakonska regulativ (2P+2S)
Teaching types	[x] Lectures [x] Seminars [ ] Exercises [ ] Fully online [ ] Combined online [ ] Fieldwork [ ] Individual assignments [ ] Multimedia [ ] Laboratory [ ] Mentoring
Student obligations	Prema Pravilniku o studiranju

Monitoring student work

Class attendance		Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1.0		
Colloquiums		Oral exam	1.0		
Written exam		Project			

Assessment and evaluation of student work	Ispit se sastoji od pismenog i usmenog dijela. Gradivo predmeta podijeljeno je na dvije cjeline koje studenti polažu preko parcijalnih pismenih ispita ili pak pristupanjem cjelokupnom ispitu na kraju semestra. Pismeni ispit se smatra položenim ukoliko studenti postignu najmanje 60% od ukupnog broja bodova. Nakon položenog pismenog dijela student stiče pravo izlaska na usmeni dio ispita. Konačna ocjena formira se temeljem ocjena iz pismenog i usmenog dijela ispita. Bodovanje: <60% student nije zadovoljio; 60-70% dovoljan (2); 70-80% dobar (3); 80-90% vrlo dobar (4); 90-100% izvrstan (5).

Required literature

Title	Number of copies available	Availability on other medium
David C. Culver and Tanja Pipan (2009): The Biology of Caves and Other Subterranean Habitats (Biology of Habitats Series)		
David C. Culver and Tanja Pipan (2014): Shallow Subterranean Habitats: Ecology, Evolution, and Conservation		

	John Gunn (2003) Encyclopedia of Caves and Karst		
	William B. White and David C. Culver (2012) Encyclopedia of Caves, Second		
	Crvene knjige Republike Hrvatske , Državni Zavod za zaštitu		
	Priručnik za određivanje podzemnih staništa u Hrvatskoj prema Direktivi o staništima EU, Državni Zavod za zaštitu prirode		
Supplementary literature	– znanstveni i stručni radovi te ostali podaci dostupni online		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Experimental Methods of Modern Physics</td></tr>
<tr><td>ID</td><td>PMP122</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Ante Bilušić</td><td>Points value (ECTS)</td><td>4.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Understanding of the theoretical background of selected experimental methods. Work on selected experimental devices and related data analysis.
Analysis of experimental methods from scientific literature.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">They meet the conditions for acquiring the qualification</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. To know the theoretical basis, operating principles, and the qualitative analysis of at least five experimental methods used in scientific research.
2. Perform practical work with at least three experimental methods from two fields of physics used in scientific research, applying the principles of laboratory work in relevant laboratories.
3. For the methods in the previous item, interpret experimental results quantitatively and qualitatively, and recognize and analyze measurement errors.
4. Use at least one computer program to quantitatively process experimental results.
5. Evaluate articles from scientific journals dealing with experimental methods (e.g., Review of Scientific Instruments).</td></tr>
<tr><td>Syllabus</td><td colspan="3">Lecturers:
• spectroscopy methods:
o light sources (2 hours)
o optical spectroscopy (3 hours),
o nuclear magnetic resonance (4 hours),
o X-ray difractometry (4 hours),
o electron microscopy (2 hours),
o atomic force microscopy (2 hours),
o gamma and neutron diffraction (1 hour),
o ultrasound difraction (2 hours)
• vacuum techniques (1 hour),
• lithography techniques (1 hour),
• thermometry and cryogenics (3 hours),
• SQUID (2 hours),
• Nuclear fusion (1 hours),
• Methods in astronomy and astrophysics (2 hours)

Seminars:
• seminar presentations of scientific articles (4 hours)
• independent work on the following experimental methods with introductory lectures (12 hours):
o scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS),
o atomic force microscopy (AFM),
o dynamic light scattering (DLS),
o UV-Vis spectroscopy.
All measurements are performed on the same samples (e.g. gold or silver nanoparticles)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☑ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Independent work on experimental instruments, data analysis, and report writing. Preparation of a seminar presentation. Attendance.</td></tr>
</table>

Monitoring student work						
Class attendance	1	Research		Practical work	
Experimental work	1	Paper	0.5		
Essay		Seminar paper			
Colloquiums		Oral exam	1.5		

	Written exam		Project				

Assessment and evaluation of student work	The mark is defined on the oral exam. The condition for taking the oral exam is positively evaluated reports on experimental work in selected experimental techniques.

Required literature	Title	Number of copies available	Availability on other medium
	Ante Bilušić, Lucija Krce, internal script, in Croatian	0	yes

Supplementary literature	[1] M. Furić, Moderne eksperimentalne metode, tehnike i mjerenja u fizici, Školska knjiga, Zagreb, 1992., in Croatian [2] R. A. Dunlap, Experimental Physics – Modern Methods, Oxford University Press, New York, 1988.
Quality assurance	1. Lecturers who have subjects with correlated learning outcomes work together to ensure quality of learning. 2. Statistics of test scores and assessment of performance in accordance with established learning outcomes. 3. Evaluation of students through an anonymous survey conducted in accordance with the regulations of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Extreme Environmental Phenomena</td></tr>
<tr><td>ID</td><td>PMP264</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Jadranka Šepić</td><td>Points value (ECTS)</td><td>4.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Provide basic knowledge on extreme processes and conditions in the environment
Enable students to extract and analyze extreme processes and conditions
Provide techniques and methods for estimating frequency and strength of extremes in a changing climate</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Basics of physics
Basics of mathematics</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Gain knowledge on extreme events in the atmosphere, lithosphere and oceans
Gain knowledge on statistics of extremes
Learn how to extract and analyze extreme events</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Definition of extremes (2 hours of lectures)
2. Ranking extreme events (2 hours of lectures)
3. Sources of extremes; preconditioning vs. Local effect (2 hours of lectures)
4. Extremes in the atmosphere: El Nino, La Nina, Hurricanes, tropical cyclones, hurricane strength winds, tornados, heat and cold waves (6 hours of lectures)
5. Extreme events in seas and oceans: storm surge, tsunami, meteotsunami, rogue waves, solitons (6 hours of lectures)
6. Extreme events in seismology: destructive earthquakes, landslides, volcanic eruptions (4 hours of lectures)
7. Statistic of extremes (6 hours of lectures)
8. Climate change and environmental extremes (2 hours of lectures)</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attend at least 70% of lectures and 70% of exercises.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1.5
Experimental work:
Essay:
Colloquiums:
Written exam:
Research:
Paper:
Seminar paper: 0.5
Oral exam: 0.5
Project:
Practical work: 1.5</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">During the semester, students will analyze a selected extreme event. This analysis will include data analysis, statistical analysis, and estimation of frequency and strength of extremes in future climate. Students will present the results of this analysis in a seminar essay. The final grade is formed based on the practical training (50%), seminar essay (25%), and oral exam (25%).</td></tr>
<tr><td>Required literature</td><td colspan="3">

Title	Number of copies available	Availability on other medium
James R. Holton & Gregory J. Hakim An Introduction to Dynamic Meteorology Academic Press, 2013.	0	da
Mirko Orlić, Uvod u fizičku oceanografiju	5	ne

</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Roland B. Stull
An Introduction to Boundary Layer Meteorology
Kluwer, 1988.

Emil Julius Gumbel
Statistics of extremes
Dover Publications, 2004</td></tr>
</table>

Quality assurance	Statistics of exam results and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Electricity and Magnetism		
ID	PMP003	Study year	1.
Lecturer	izv. prof. dr. sc. Petar Stipanović doc. dr. sc. Lucija Krce	Points value (ECTS)	9.0
Associates		Class execution (number of hours in semester)	L: 60, S: 15, E: 30, P: 0
Subject status	Compulsory	Online percentage	20%

Subject description	
Subject goals	Understanding the basics of electrodynamics.
Enrolment requirements	Prior knowledge of elementary mathematics which was confirmed at the state graduation exam in mathematics, A-level.
Learning outcomes	1. Develop a simple physical model applicable to solving a given problem in the field of electromagnetism. 2. Formulate mathematically a given physical model from the field of electromagnetism, and solve and evaluate numerical problems for known systems from the field of electromagnetism. 3. Demonstrate knowledge of the basic principles of electrostatics and Coulomb's law, as well as Gauss's law and its application. 4. Demonstrate knowledge of Kirchhoff's rules for circuits and their application. 5. Qualitatively and quantitatively describe and connect the electric and magnetic field of charges in motion. 6. Apply knowledge of the basic principles of magnetostatics, Biot-Savart's and Ampere's laws, and Faraday's law of electromagnetic induction. 7. Qualitatively describe and compare the magnetic properties of materials (dia-, para- and ferro-magnetism). 8. Define and distinguish the basic terms and laws related to the concept of alternating current, and apply the methods of rotating vectors and complex numbers when solving problems related to alternating current circuits. 9. Demonstrate knowledge of Maxwell's equations and electromagnetic waves in a vacuum.
Syllabus	Seminars (1 h) and exercises (2 h) following the lectures (4 h) in units: 1. Electric charge. Coulomb's law. 2. Scalar and vector fields. Electric field. 3. Nabla operator. Gauss and Stokes theorem. Gauss's law in electrostatics. 4. Electric potential. Poisson's and Laplace's equation. 5. Electrical capacity and energy. 6. Electric current. Ohm's law. Kirchhoff's rules. 7. Complex circuits. 8. Electric and magnetic field of charge in motion. 9. Charge path. A conductor in a magnetic field. Applications (accelerators, Hall effect). 10. Biot-Savart and Amperé's law. Magnetic vector potential. 11. Faraday's law of electromagnetic induction. Lenz's rule. 12. Maxwell's equations. Electromagnetic waves. 13. Alternating currents in circuits. Method of rotating vectors. Method of complex numbers. Transformers. 14. Electric fields in substances. Dielectrics. Polarization. 15. Magnetic fields in (dia-, para- and ferro-magnetic) materials. Magnetization.
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	1. Active participation on lectures by giving critical judgment and argumentation of opinions, asking and answering questions. 2. Solve given problems from electromagnetism.

Monitoring student work						
	Class attendance	3.5	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	0.5		

	Colloquiums		Oral exam	2.5		
	Written exam	2.5	Project			

Assessment and evaluation of student work	The final grade is formed after the student passes both test parts: written exam (problem solving, 50% rating) and oral exam (theory, 50% rating). During classes, short tests of learning outcomes are carried out, through which it is possible to be exempted from part of the exam, and colloquia (problems tasks) which are equivalent to the written exams.

Required literature	Title	Number of copies available	Availability on other medium
	E. M. Purcell (translated by Ksenofont Ilakovac): Elektricitet i magnetizam, Berkeley Course, Tehnička knjiga, Zagreb,1988.	14	yes
	Halliday, Resnick, Walker: Fundamentals of Physics, John Wiley & Sons, different editions.	21	yes
	R. P. Feynman, R. B. Leighton, M. Sands, The Feynman Lectures on Physics, vol. II, Addison-Wesley, 1978. URL: https://www.feynmanlectures.caltech.edu	2	yes
	E. Babić, R. Krsnik i M. Očko: Zbirka riješenih zadataka iz fizike, Školska knjiga, Zagreb 2004.	12	no

Supplementary literature	[1] Lecture notes, PMFST. [2] I. E. Irodov: Problems in General Physics, Roorkee: CL Media.
Quality assurance	1. Lecturers who teach subjects, which have correlated learning outcomes, collaborate and take care of teaching quality. 2. Statistics of exam results and evaluation of efficacy in accordance with the learning outcomes. 3. Student evaluation by anonymous survey conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Electrodynamics</td></tr>
<tr><td>ID</td><td>PMP118</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Damir Kovačić</td><td>Points value (ECTS)</td><td>8.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 45
S: 15
E: 30
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Upoznati studente s osnovama klasične elektrodinamike.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Nema</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Objasniti svojstva električnog naboja
2. Objasniti osnovne zakone elektrostatike; Coulombov i Gaussov zakon; Laplaceovu i Poissonovu jednadžbe
3. Objasniti metodu zrcalnih naboja i Greenovu funkciju
4. Objasniti sferne harmonike i multipolni red
5. Objasniti osnovne zakone magnetostatike; Faradayev zakon i Maxwellove jednadžbe
6. Objasniti valnu jednadžbu i svojstva elektromagnetskih valova
7. Objasniti koncepte energije, impulsa i angularnog momenta elektromagnetskog polja</td></tr>
<tr><td>Syllabus</td><td colspan="3">Električni naboj – svojstva i raspodjele. Diracova δ-funkcija. Gustoća naboja i struja.
Elektrostatika – električna sila, električno polje i skalarni potencijal. Gaussov zakon. Maxwellove jednadžbe za elektrostatiku. Poissonova jednadžba. Rubni uvjeti – Dirichletovi, Neumannovi i mješoviti. Grenova funkcija za Poissonovu jednadžbu.
Zrcalni naboji. Sfera/kugla i točkasti naboj. Laplaceova jednadžba u Cartesian i sfernim koordinatama. Sferni harmonici.
Dielektrici. Energija električnog polja.
Razvoj potencijala u multipolni red. Multipolni momenti.
Električna struja. Magnetostatika. Biot.Savartov zakon.
Faradayev zakon indukcije. Energija magnetskog polja. Feromagneti.
Maxwellove jednadžbe.
Elektromagnetski potencijali. Gauge transformacije i gauge simetrija elektrodinamike.
Valna jednadžba i njena Greenova funkcija.
Linearni materijali.
Poyntingov teorem. Energija, impuls i angularni moment EM polja.
Elektromagnetski valovi i njihova svojstva. Zakoni geometrijske optike. Disperzija i disipacija.
Emisija EM valova. Zračenje dipola.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Pohađanje predavanja, seminara i vježbi. Za stjecanje prava na potpis student treba nazočiti na najmanje 50% predavanja i vježbi.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 3 · Research: · Practical work:
Experimental work: · Paper:
Essay: · Seminar paper:
Colloquiums: · Oral exam: 3
Written exam: 2 · Project:</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">U konačnu ocjenu ulazi:
1. Pismeni ispit (ili kolokviji) – 40% ocjene,
2. Usmeni ispit – 60 % ocjene.
Za prolaz pismenog ispita potrebno je riješiti najmanje 50% zadataka. Student se može osloboditi pismenog ispita preko dva kolokvija. Na oba kolokvija potrebno je riješiti najmanje 50% zadataka</td></tr>
<tr><td>Required literature</td><td></td><td>Number of</td><td>Availability on</td></tr>
</table>

	Title	copies available	other medium
	[1] Griffiths, David J., Introduction to Electrodynamics (Prentice Hall, New Jersey, 1999)	1	Online
	[2] Jackson, David J., Classical Electrodynamics (John Wiley and Sons, New Jersey 1998)	3	Online
Supplementary literature	I. Supek, Teorijska fizika i struktura materije		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

Subject name	Elementary geometry		
ID	PMM019	Study year	2.
Lecturer	izv. prof. dr. sc. Jurica Perić	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	30%

Subject description	
Subject goals	The aim of the course is to systematise, consolidate and deepen the knowledge of elementary (Euclidean) geometry setting the foundation strictly axiomatic. Within this axiomatisation classic model of Euclidean geometry will be processed and introduction for other models and geometry will be made.
Enrolment requirements	/
Learning outcomes	The student is able to: – list the axioms of planimetry and stereometry – describe the history of the study of Euclid's fifth postulate – list isometries of the plane, express and reproduce their basic properties – describe triangle, circle and square and reproduce basic theorems, define a polygon and polygon area, show the areas of the basic polygons – define the volume of polyhedrons and show volumes of the basic polyhedrons – express and prove the claims of stereometry using previously proven claims from planimetry – solve the task corresponding to the theoretical concepts worked during the course – explain the significence of Euclidean geometry in mathematics, its historical and intuitive importance, and the reasons for the occurance of other geometries, primarily hyperbolic geometry
Syllabus	Planimetry: – five groups of axioms – 2 hours – some properties of isometry, symmetries – 4 hours – angles and some theorems about them – 2 hours – 5. Euclidean postulate – 2 hours – congruence of triangles, similarity of triangles – 4 hours – circles, tendon and tangential rectangle – 4 hours Polygons, polygon area – 6 hours Stereometry – the geometry of space – prisms, pyramids, cylinders, cones – 3 hours – polyhedrons and volume – 3 hours
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Attendance at 70% of lectures and 70% of exercises.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	1	Oral exam	3		
Written exam	1	Project			

Assessment and evaluation of student work	The exam is taken in written and oral form. Written exam is preliminary part of the exam and requirement for the oral exam is to pass a written exam. The written form of the exam can be taken partially, during class, where curriculum provided. Activity in class, solving homework, colloquium, written and oral examination are the elements from which form the final grade is formed.

Required literature

Title	Number of copies available	Availability on other medium
B. Pavković, D. Veljan, Elementarna matematika 1,		

	Tehnička knjiga, Zagreb, 1991.		
	B. Pavković, D. Veljan, Elementarna matematika 2, Školska knjiga, Zagreb, 1995.		
Supplementary literature	D. Palman, Planimetrija, Element, Zagreb,1998. D. Palman, Stereometrija, Element, Zagreb, 2005.		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="6">Energetics</td></tr>
<tr><td>ID</td><td>PMT168</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Ivan Peko</td><td>Points value (ECTS)</td><td colspan="4">4.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>15</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">30%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Adopt basic knowledge of energetics and energy conversion and form a critical opinion about the efficient use of energy sources.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">none.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">After this course, students will be able to:
- Distinguish between renewable and non-renewable energy sources.
- Describe the formation of fossil fuels
- Distinguish energy facilities.
- Describe the working principle of energy facilities.
- Compare energy conversion plants.
- Represent and defend the argument attitude about the use of certain energy sources
- Represent and provide arguments to defend position on the construction of the power plant in Croatia.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Week 1
An introductory lecture, introducing students to the rules and literature. Introduction to content of the course. Introduction to energetics, energetic concept, the concept of energy. The law of conservation of energy. Energetics, energy and power. Energy conversion. The primary and transformed energy forms.

Week 2
Entropy and the world. Energetics yesterday, today, tomorrow. History of energy use. World and energetic. Sustainable development of energetics and sustainability of energy system. Assessment methods of sustainable development of energy systems: External cost, multicriteria analysis, exergy, emergy.

Week 3
Nonrenewable energy sources. Reserves of nonrenewable energy sources. The formation of fossil fuels. Carbon. Fossil fuels: coal, oil, natural gas, nuclear energy. Estimation of non-renewable energy sources.

Week 4
Renewable energy sources, the Kyoto Protocol. European objectives. The potential of renewable energy sources. Energy water (hydropower). The energy of the sun. Wind energy. Wave energy. Tidal power and energy from the sea. Biomass and biomass potential in Croatia. Biodiesel. Geothermal energy.

Week 5
Plants for converting energy. Centralized energy facilities. Centralized heating systems. Thermal power plants - power plants and diesel power plants, the thermal power station with a steam turbine, the thermal power station with gas turbine. Parts of the thermal power plant. Thermal power plants in Croatia.

Week 6
Nuclear power plants: The historical development. Principle of operation and basic division of nuclear power plants. Types of nuclear power plants. Nuclear energy compared to other energy sources. Safety of nuclear power plants. The development and goal of nuclear energy.

Week 7
1st colloquium

Week 8
Hydropower plants: Description of the plant. Division of hydropower plants. Storage hydropower plant. River hydropower plants. The pumped storage plants. Low-pressure, medium-pressure and high-pressure hydro power. Parts of hydropower</td></tr>
</table>

plants. Types of water turbines (Pelton, Francis and Kaplan turbines). Hydroelectric power plants in Croatia.

Week 9
Solar energy. Insolation. Solar collectors. Photovoltaic cells – development, implementation and cost-effectiveness. Photo-voltage solar potential in Europe. The impact on the environment. Solar power plants.

Week 10
Wind energy. The kinetic energy of the wind. The statistics of wind, wind atlas, wind rose. Influence of terrain on the wind farm choice of location. Wind power plants. The basic division of wind power plants, main parts wind power plants. Principle of operation wind power plants. Selection of generators and mechanical systems of wind power plants. Connecting wind power plants to the electricity grid. Market of wind energy.

Week 11
The oceans as energy collectors. Methods of ocean energy conversion into electric energy: Tidal power, energy of sea waves, OTEC, other theoretical and practical technology. Tidal power: division, potential for and against. Plants for converting energy of sea waves. Ocean Thermal Energy Conversion (OTEC). Types of OTEC plants. Other technologies.

Week 12
Geothermal energy. Geothermal power plants. Types of geothermal power plants: dry steam principle (Dry steam) The principle of steam separation (flash steam), binary principle (binary cycle). Geothermal potential in Croatia.

Week 13
Biomass. Energy from biomass. Heat pumps. The development of heat pump technology. The theoretical principle of the heat pump. Parts of heat pumps.

Week 14
Croatia and world from the aspect of energetics. Energy Development Strategy in Croatian. The national program of energy development. Energetic present and future.

Week 15
2nd colloquium and student paper presentations.

Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐
Student obligations	Class attendance Independent planning and presentation of student paper Active participation in the teaching process Exam.		

Monitoring student work

Class attendance	1.5	Research		Practical work	
Experimental work		Paper		Self-study for exam	1.5
Essay		Seminar paper	1		
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work

Total scoring (100%):
Exam or 2 colloquiums – 90%, student paper 10%
1. Colloquium 1: 45% (or exam)
2. Colloquium 2: 45% (or exam)
3. Student paper: 10% (obligatory)

Rating by percentage:
50% to 62% – sufficient (2)
63% to 75% – good (3)

	76% to 88% – very good (4) 89% to 100% – excellent (5)
Required literature	<table><tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr><tr><td>B. Udovičić, Energetika, Školska Knjiga, Zagreb, 1993.</td><td></td><td></td></tr><tr><td>Energetika – predavanja – interna skripta i online materijali.</td><td></td><td></td></tr></table>
Supplementary literature	1. V. Paar, Energetska kriza:gdje (ni)je izlaz?, Školska knjiga, Zagreb, 1984. 2. H. Požar, Osnove energetike I, II i III, Školska knjiga, Zagreb,1992. 3. P. Kulušić, Novi izvori energije, Školska knjiga, Zagreb, 1991. 4. W.E. Westman, Ecology, Impact, Assessment and Environmental Planning, J. Wiley, 1985. 5. Časopis Energija 6. Renewable Energy, edit.by Godfrey Boyle, Oxford University Press, 2004. 7. Internet
Quality assurance	Conversation with the students. Students opinions about the quality of teaching through anonymous polls. The success of students at exam. Self-evaluation.
Other (in the opinion of the proponent)	

Subject name	Energy and environment						
ID	PMT175	Study year	2.				
Lecturer	doc. dr. sc. Ivan Peko	Points value (ECTS)	2.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			15	15	0	0	
Subject status	Elective	Online percentage	30%				
Subject description							
Subject goals	Adopt basic knowledge of energetics with emphasis on the impact on the environment.						
Enrolment requirements	None						
Learning outcomes	After this course, students will be able to: – Represent and provide arguments to defend position on the impact of energy on the environment – Distinguish transformation in Electric Power Systems – Evaluate the impact of energy sector development in contribution to the environment – Evaluate and argument the impact of climate change on energy and environment relationship – Explain the global environmental issues – Explain the Sustainable Energy Management						
Syllabus	Week 1 Introduction. Introducing students to the rules, literature and teaching plan. Explaining the course content. Introduction to energetics and environmental impacts. Week 2 The law of conservation of energy states, forms of energy, primary, transformed and useful forms of energy. Sustainable energy development and evaluation of sustainable development of energy systems. Week 3 The entropy from the world point of view. Energy yesterday, today, tomorrow. History of energy use. World and energy. Sustainable energy development and sustainability of the energy system. Methods for assessment the sustainable development of energy systems: External cost, multicriteria analysis, exergy, emergy. Week 4 Prognosis of energy development. Projections for the development of the energy sector in the world and Croatia. Week 5 Features of energy sources, impact on the environment, emissions in the energy and climate change Week 6 Conversions to electric power. The ability of electrical energy conservation. Week 7 Primary and transformed energy forms supply process. The share of energy in the cost of products. Waste Heat and assessment of their energy potential Week 8 1st colloquium Week 9 Climate change and the possibility of an impact on them. Week 10 Energy system development planning. Proposing measures to increase energy efficiency and selection of available technology in accordance with the defined objectives and the level of planned investment. Week 11						

	Energy markets Week 12 Global environmental problems Week 13 Substitution sources: renewable and non-renewable sources, availability, technical applicability, effectiveness, substitution criteria, the application of cogeneration. Examples of energy structure optimization in the energy-intensive processes (production of chemicals, paper, plastics, wood, metallurgy, etc.) Week 14 Sustainable energy management on a global scale: The Kyoto Protocol, a network of industrial energy efficiency, green and white certificates. Week 15 2nd colloquium and student paper presentations.
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Class attendance Independent planning and presentation of student paper Active participation in the teaching process Exam.
Monitoring student work	(see table below)

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	0.5		
Colloquiums		Oral exam	0.5		
Written exam		Project			

Assessment and evaluation of student work	Total scoring (100%): Exam or 2 colloquiums - 90%, student paper 10% 1. Colloquium 1: 45% (or exam) 2. Colloquium 2: 45% (or exam) 3. Student paper: 10% (obligatory) Rating by percentage: 50% to 62% - sufficient (2) 63% to 75% - good (3) 76% to 88% - very good (4) 89% to 100% - excellent (5)
Required literature	(see table below)

Title	Number of copies available	Availability on other medium
B. Udovičić, Energetika, Školska Knjiga, Zagreb, 1993.		
Predavanja - energetika i okoliš - online		

Supplementary literature	1. D. Foretić i ostali, Elektrane i okoliš, Element, Zagreb, 2000. 2. Renewable Energy, edited by Godfrey Boyle, Oxford University Press, 2004. 3. UNDP Environmental Governance Sourcebook, Regional Bureau for Europe, 2003 4. Internet
Quality assurance	Conversation with the students. Students opinions about the quality of teaching through anonymous polls. The success of students at exam. Self-evaluation.
Other (in the opinion of the proponent)	

Subject name	Evolucija						
ID	PMB241	Study year	2.				
Lecturer	prof. dr. sc. Jasna Puizina	Points value (ECTS)	2.5				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	0	0	
Subject status	Compulsory	Online percentage	10%				
Subject description							
Subject goals	Razviti svijest u studenata da evolucija nije samo teorija nego znanstvena činjenica utemeljena na ogromnim količinama materijalnih dokaza iz različitih znanstvenih disciplina (biologija, fizika, kemija, paleontologija, geologija, antropologija i druge). Znati osnovne činjenice i zakonitosti razvoja živog svijeta. Upoznati studente s najnovijim otkrićima iz područja molekularne evolucije. Dobivena znanja nužna su za integrativno razumijevanje biologije kao znanstvene discipline, te izgradnju znanstveno-utemeljenog shvaćanja razvoja života na Zemlji.						
Enrolment requirements	Nema ih.						
Learning outcomes	1.Razumjeti činjenice i zakone razvoja života na Zemlji. 2.Argumentirati i potkrijepiti dokazima evolucijske procese. 3.Razlikovati evoluciju od drugih neznanstvenih teorija o razvoju života na Zemlji. 4.Objasniti važnost evolucijskih procesa na primjerima iz svakodnevnog života						
Syllabus	Predavanje 1.Povijesni pregled evolucijskih misli, Darwinov život i selekcijska teorija (2 sata) Ishodi učenja: Razumjeti važnost evolucije u okviru biologije te šire u društvu za formiranje znanstveno-utemeljenog shvaćanje razvoja života na Zemlji. Znati povijesne činjenice o životu i radu Charlesa Darwina, te znati Darwinovu teoriju prirodnog odabira. Znati za protuevolucijske ideje kreacionizma i inteligentnog dizajna. 2.Moderna evolucijska sinteza. Teorija o isprekidanim ravnotežama. (2 sata) Ishodi učenja: Znati kako se Darwinova selekcijska teorija uklopila i u suvremenu biološku znanost i kako suvremena istraživanja podupiru tu teoriju. Znati da teorija o isprekidanim ravnotežama modificira poimanje tempa evolucije (nejednak i diskontinuiran, umjesto jednolikog, kontinuiranog), te da to značajnije ne mijenja Darwinovu teoriju. 3.Paleontološki dokazi evolucije (2 sata). Ishodi učenja: Znati kako nastaju fosili, kako im se određuje starost, najvažnija svjetska nalazišta. Znati glavne kategorije fosila (razvojni nizovi, prijelazni oblici), te najvažnije suvremene žive fosile. 4.Usporedbeno-anatomski, biogeografski i fiziološki dokazi evolucije. (2 sata) Ishodi učenja: Znati na koji način usporedbeno anatomski dokazi podupiru teoriju evolucije (homologni, analogni, rudimentarni organi, atavizmi, usavršavanje organa). Znati važnost biogeografskih dokaza evolucije koji svjedoče da je razvoj života tijesno povezan s geološkim promjenama na Zemlji. Znati navesti osnovne specifičnosti flore i faune za šest temeljnih zoogeografskih područja,te specifičnosti otočkih flora i fauna. Znati da su temeljni fiziološki procesi (asimilacije i disimilacije) zajednički i visoko srodni među srodnim skupinama živih bića na Zemlji. Znati kako razvoj embrija različitih skupina živih bića odražava evolucijski tijek. 5.Molekularno-biološki i genetički dokazi evolucije (2 sata). Ishodi učenja: Znati molekularne mehanizme evolucije genoma. Znati da se na temelju primarne strukture molekula DNA i proteina može odrediti sistematsko-taksonomska pozicija te rekonstruirati filogenetski podrijetlo različitih skupina živih bića. Znati metode istraživanja nukleinskih kiselina i proteina, metode izrade filogenetskih stabala, poznavati koncept molekularnog sata, Kimurine teorije neutralnih mutacija i selekcionističke teorije. 6.Živi svijet u prošlosti (2 sata). Ishodi učenja: Znati geološku skalu vremena, njezinu razdiobu na eone, ere, periode i epohe. Za svako razdoblje znati glavna obilježja flore i faune. Znati približno vrijeme pojave, ekspanzije i nestanka glavnih skupina živih bića na Zemlji. 7.Velika izumiranja (2 sata). Ishodi učenja: Znati paleontološke, geološke i druge metode kojima je dokazano pet velikih izumiranja u posljednjih 500 milijuna godina. Znati razdoblje događanja, vjerojatne uzroke i posljedice tih izumiranja. Znati materijalne dokaze udarca meteorita u Zemlju. Razumjeti posljedice recentnog izumiranja za koje je odgovoran čovjek. 8.Postanak planeta Zemlje i početci života na Zemlji (2 sata). Ishodi učenja: Znati znanstveno-prihvaćeno tumačenje postanka planeta Zemlje, njezinog postepenog						

<table>
<tr><td></td><td>geološkog razvoja, stvaranja preduvjeta za pojavu prvih oblika života. Poznavati najstarije materijalne (paleontološke) oblike života na Zemlji, njihovu starost, nalazišta.
9.Abiogenetska sintez organske materije (2 sata). Ishodi učenja: Znati razvoj žive prirode iz nežive, kemijska evolucija. Nastanak prvih makromolekularnih sustava. Nastanak prvih protobionata
10.RNA svijet (2 sata). Ishodi učenja: Znati najnovija otkrića iz područja RNA biologije te implikacija tih otkrića za evoluciju i nastanak prvog genetičkog materijala.
11.Revizija molekularne sistematike i novo razvojno stablo živog svijeta (1 sat). Ishodi učenja: Znati promjenu sistematike temeljene na podjeli živih bića u dva carstva (prokarioti i eukarioti) u sistematiku temeljenu na podjeli živih bića na tri carstva (eubakterije, arhebakterije i eukarioti) do koje je došlo nakon primjenom molekularno-genetičkih metoda u istraživanjima odnosa među živim bićima. Znati posebitosti molekularne strukture i ekologije arhebakterija.
12.Evolucija metabolizma i endosimbiontska teorija o postanku eukariotske stanice (1 sat). Ishodi učenja: Znati evoluciju metabolizma (od primitivnijih anaerobnih do novijih aerobnih mehanizama proizvodnje energije). Znati pojavu fotosinteze, autotrofnih organizama i njihovog značaja za razvoj ostalih oblika života na Zemlji. Znati endosimbiontsku teorija o podrijetlu eukariotskih stanica, te glavne materijalne dokaze te teorije.
13.Pokretačka sila evolucije 1. - varjabilnost živih bića (2 sata) Ishodi učenja: Znati mehanizme nastanka varjabilnosti živih bića na Zemlji (mutacije, duplikacije, rekombinacije, transpozicije, promjene frekvencije alela, genetički drift, poliploidija)
13: Pokretačka sila evolucije 2 - prirodna selekcija. Specijacija. (2 sata) Ishodi učenja: Znati mehanizme prirodne i seksualne selekcije, te njihovu važnost u procesima nastanka novih vrsta (specijacija) i njihovih ekoloških adaptacija. Znati različite koncepte vrsta, tipove specijacija.
14.Evolucija čovjeka (2 sata) Ishodi učenja: Razumjeti da je čovjek kao i sva ostala živa bića na Zemlji rezultat dugotrajne biološke evolucije, te da mu prethodi mnoštvo starijih , danas izumrlih, oblika. Razviti prirodo-znanstveni pogled na svijet i život, utemeljen na rezultatima paleontoloških, molekularno-bioloških i mnogih drugih znanstvenih istraživanja. Znati karakteristike i srodnost čovjeka ostalim primatima. Znati najstarije čovjekolike fosilne vrste (Ardipithecus, Australopithecus), obilježja njihovih kostura, pojavu bipedalnosti. Znati najstarije predstavnike roda Homo (H. habilis, H. erectus, H. ergaster, H neanderthalensis, H. floresiensis), znati promjene u volumena mozga, obilježjima kostura, migracijama, nastambama, prehrani, načinu života.
15.Evolucija čovjeka (1 sat), film o životu neandertalaca (1sat) Ishodi učenja: Znati glavne rezultate analiza mitohondijske DNAu suvremenih ljudi i neandertalaca, koncept mitohondrijske Eve i Y kromosom Adama. Znati glavna otkrića proizišla iz sekvenciranja genoma neandertalaca i njegove usporedbe s genomom suvremenog čovjeka. Shvatiti utjecaj tih rezultata na razumijevanje evolucije suvremenog čovjeka. Znati monocentričnu, 'Out of Africa' teoriju o nastanku i migracijama prvih pripadnika H. sapiens. Razumjeti raznolikosti među suvremenim ljudima, razlike u pigmentaciji kože i drugim fenotipskim karakteristima, koncept rasa.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring
☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td>Prisustvovanje nastavi najmanje 70%. Položiti dva kolokvija ili pismeni ispit</td></tr>
<tr><td>Monitoring student work</td><td><table>
<tr><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1.5</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td>Ispit je pismeni, a može se položiti i tijekom nastave kroz dva kolokvija. Način vrednovanja ukupno prikupljenih bodova (max = 100): 90% - 100% ocjena 5 (izvrstan), 80% - 90% ocjena 4 (vrlo dobar), 65% - 80% ocjena 3 (dobar), 55% - 65%ocjena 2 (dovoljan),< 55% ocjena 1 (nedovoljan). Provjera znanja gradiva vrši se putem pismenog ispita koji se sastoji od zadataka na zaokruživanje, nadopunjavanje, opisivanje i označavanje na slici, te triju esejskih pitanja. Redovan rad tijekom semestra se vrednuje omogućavanjem polaganja ispita u vidu dva parcijalna kolokvija</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">tijekom izvođenja nastave. Studentima se tijekom semestra nudi mogućnost osvajanja dodatnih bodova (max. 5%) putem kratkih kvizova, te bodovanjem usmenih odgovora na postavljenja pitanja tijekom predavanja i rješavanja domaćih uradaka. Student je dužan riješiti minimalno 55% ispita. Stopostotno pohađanje vježbi će se nagraditi s 2% na ispitu.</td></tr>
<tr><td rowspan="2">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Puizina, J. 2015: Evolucija</td><td></td><td>web</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">http://evolbiol.ru/docs/docs/large_files/why_evolution_is_true.pdf http://www.blackwellpublishing.com/ridley (Mark Ridley, Evolution, 3rd ed) http://evolution.berkeley.edu/evolibrary/article/evo_01 Mirjana Kalafatić, 1998: Osnove biološke evolucije, Zagreb Richard Dawkins: Najveća predstava na Zemlji, Izvori, 2008 Richard Dawkins: Sebični gen. Izvori, 1997. Matt Ridley: Genom. Izvori, 1997. Brian Sykes: Sedam Evinih kćeri. Naklada Zadro. Zagreb 2002. Brian Sykes: Adamovo prokletstvo – budućnost bez muškaraca, Algoritam, Zagreb, 2006. Geoffrey Miller: Razum i razmnožavanje</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="7">Financial mathematics</td></tr>
<tr><td>ID</td><td>PMM306</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>dr. sc. Ana Perišić</td><td>Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">30%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">An introduction to fundamental concepts of financial mathematics required for understanding and correct interpretation of mathematical models in finance. Acquiring essential financial modelling skills through presentation of applied mathematical techniques in financial practice covered by many examples.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">–</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Students will be able to:
– explain the concept of the time value of money,
– differentiate between nominal, proportional and effective interest rate,
– calculate and interpret present and future values of cash flows,
– construct amortization schedules for different loan repayment methods,
– apply basic capital budgeting techniques,
– demonstrate knowledge of modern portfolio theory,
–construct the efficient frontier,
– evaluating bonds, bond portfolios and evaluating options,
– applying different risk assessment techniques,
– carrying out basic calculations in financial mathematics in a computer-supported way,</td></tr>
<tr><td>Syllabus</td><td colspan="6">Lectures/Exercises:
1. Time value of money, simple and compound interest types of interest rates. (2h/2h)
2. Present and future values of cash flows; general annuities, perpetuities, continuous interest. (2h/2h).
3. Loan. Different loan repayment methods. Rescheduled loans. (2h/2h).
4. Intercalary interest. Effective interest. (2h/2h).
5. Capital budgeting techniques (2h/2h).
6. Bond: value, price, yield and duration. Duration of a portfolio of bonds. (2h/2h)
7. Immunization. Modeling the term structure (2h/2h).
8. Fundamental concepts of modern portfolio theory, portfolio means and variances, variance-covariance matrix. (2h/2h).
9. Efficient portfolios, efficient frontier, CAPM. (3h/3h).
10. Asset risk. Portfolio risk (2h/2h).
11. Basic option definitions and terminology. Option payoff and profit patterns, option arbitrage propositions (3h/3h).
12. The Binomial Option-Pricing Model (2h/2h).
13. The Black-Scholes Model (2h/2h).
14. Option Greeks (2h/2h)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="3">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Attending lectures, writing homework and writing a seminar assignment.</td></tr>
</table>

<table>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>0.1</td><td>Research</td><td></td><td>Practical work</td><td>0.5</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>0.4</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>3</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Attending lectures, writing homework, writing a seminar assignment, written and oral exam. During the semester, students have the possibility to partially take written exams through colloquia (twice during the semester). Students whopass both colloquiadon't need to take part in the writtenexam.</td></tr>
</table>

<table>
<tr><td rowspan="4">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Z. Babić, N. Tomić-Plazibat, Z. Aljinović, Matematika u ekonomiji, Sveučilište u Zagrebu, 2009</td><td></td><td></td></tr>
<tr><td>B. Šego, Z.,Lukač, Financijska matematika, Sveučilište u Zagrebu, 2011.</td><td></td><td></td></tr>
<tr><td>Z. Aljinović,B. Marasović, B.Šego, Financijsko modeliranje, Sveučilište u Splitu, 2011.</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">J. Cvitanić, F. Zapatero, Economics and Mathematics of Financial Markets, The MIT Press, 2004
S. Benninga, Financial modeling, 3rd ed, The MIT Press, Cambridge, 2008
Šegota, A. Financijska matematika, Sveučilište u Rijeci, 2012.
Babić, Z., Tomić-Plazibat, N., Poslovna matematika, Ekonomski fakultet, Split, 2004.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Summarizing test results and conducting an anonymous student survey at the end of the course. The survey is conducted according to the rules of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="6">Solid State Physics</td></tr>
<tr><td>ID</td><td>PMP201</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Željana Bonačić Lošić</td><td>Points value (ECTS)</td><td colspan="4">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">20%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">• To familiarize students with basic condensed matter physics concepts based on statistical and quantum mechanics cognitions using mainly semi-classical models.
• Comprehension of experimental occurrences in crystal structures based on microscopic physical models is expected as well as the ability to quantitatively describe and solve problems using adequate mathematical formalism.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">• quantum mechanics
• statistical mechanics
• electrodynamics</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">• To describe basic crystallographic systems, crystallographic defects and diffraction of EM waves on a crystal lattice.
• To explain characteristics of interatomic bonds in crystals and their impact on energy cohesion and macroscopic properties of solids.
• To analyze spectral functions of phonons and their contributions to internal energy, heat capacity and thermal expansion.

• To explain the gas model of free electrons and the physical quantities derived from it.
• To analyze electron energy spectrum in periodical potential and electron and electron hole properties.

• To explain transport and thermodynamic properties of metals, semiconductors and insulators.
•
• To explain dielectric properties of matter.

• To explain atomic magnetism and magnetism of matter.

• To explain occurrence and properties of superconductivity.

• To explain basic experimental techniques in physics of condensed matter.</td></tr>
<tr><td>Syllabus</td><td colspan="6">1st week: Introduction class (introducing students and lecturers, description of work methods, student obligations and evaluations of achievements, description of the solid state physics research area, role of condensed matter physics in technology and civilization development, basic experimental methods).

2nd week: Crystals and crystal structures (types of crystals, crystal lattice, elementary cell, operations of symmetry, quasi-crystal, Bravais lattice).

3rd week: Crystal lattice and defects (crystal lattices, reciprocal lattice, direct and momentum space, diffraction of x rays, crystal defects, Schottky's defects, Frankel's defects, elemental excitations).

4th week: Interatomic bonds and cohesion energy (covalent bond, ionic bond, Van der Waals bond, hydrogen bond, metallic bond).

5th week: Oscillations of single-atom linear crystal lattice (wave equation, group velocity, Brillouin zone, wave number recounting).

6th week: Oscillations of two-atom linear crystal lattice (oscillations of crystal lattice with two atoms in the primitive cell, acoustic oscillations, optical oscillations)

7th week: Ionic crystals in electromagnetic field, dipole moment of the atom, polarizability of atoms and molecules.</td></tr>
</table>

	8th week: Phonon contribution to heat capacity of crystals (acoustic and optical phonons, Debye and Einstein approximation, heat capacity of the crystal cell, Dulong-Petit rule). Heat expansion of crystal. 9th week: Sommerfeld model of metals (types of metals and their properties, Drude and Sommerfeld model of metals, Fermi energy, density of electronic states, Sommerfeld expansion, heat capacity of electron gas). 10th week: Electron in the periodic potential (Schrödinger equation for electron in the periodic potential, Bloch theorem, electron energy bands, electron hole, effective mass, van Hove singularities). 11th week: Transport phenomena (Drude model of electric conductivity, Ohm's law, Joule's heat, Matthiessen's and Nordheim's rule, phonon contribution to electrical resistance, Hall effect, Heat conductivity, Wiedemann-Franz law). 12th week: Semiconductors (types of semiconductors, zone structure of semiconductors, doped semiconductors, electron and hole conductivity of semiconductors). 13th week: Atomic magnetism (spin and orbital magnetic moment, Hund's rules, atomic paramagnetism, magnetization for J=1/2, Brillouin function, Langeven atomic diamagnetism). 14th week: Magnetic properties of matter (paramagnetism and diamagnetism of free electrons, quantum theory of ferromagnetism, magnetic domains and hysteresis, Weiss theory of molecular field, antiferromagnetism, Curie – Weiss law). 15th week: Superconductivity (Meissner effect, isotopic effect, type 1 and type 2 superconductors, electron – phonon coupling, Cooper pairs, BCS theory, superconductivity gap, critical temperature, critical current, Josephson effect).
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Attendance of at least 50% of lectures and exercises. At least 50% of solved homework problems handed in.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper		Domaće zadaće	0.5
Essay		Seminar paper			
Colloquiums		Oral exam	2		
Written exam	1.5	Project			

Assessment and evaluation of student work	Evaluation of student achievements and activities are graded as follows: • class attendance – up to 10 points • homework problem solving – up to 10 points • written exam – up to 30 points • oral exam – up to 50 points Written exam is consisted of problems (exercises) that need to be solved. This exam can be passed during the semester via two colloquia. In order to attend the oral exam, student must solve at least 50% of problems in the written exam and must fulfill all requirements to get the professor's signature. In order for student to pass the exam via colloquia, he or she must solve at least 50% of all problems from both colloquia. Oral exam is consisted of 5 questions from different content units. These questions are randomly selected from an initially known list of question. Grades are given according the following score ranges: • 89 – 100 points : excellent • 76 – 88 points: very good • 63 – 75 points: good • 50 – 62 points: enough

Required literature		Number	

	Title	of copies available	Availability on other medium
	C. Kittel, Introduction to Solid State Physics, 8th edition, John Wiley & Sons, Inc.,2005.	11	
	V. Šips, Uvod u fiziku čvrstog stanja, Školska knjiga Zagreb, 1991.	8	
	V. Šips, Uvod u fiziku čvrstog stanja, Školska knjiga Zagreb, 2003.	5	
Supplementary literature	G.I.Epifanov, Solid State Physics, MIR Publishers, Moscow, 1979.		
Quality assurance	• Evaluation of student achievements in accordance with expected outcomes • Lecturer's self-evaluation • Student feedback through questionnaires • In-institution and out-institution review		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Elementary Particle Physics I</td></tr>
<tr><td>ID</td><td>PMP20E</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Marko Kovač</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 45, S: 0, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>25%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Stjecanje osnovnih znanja i kompetencija iz fizike elementarnih čestica.
Predmet objedinjuje znanja stečena u predmetima kvantne mehanike i klasične elektrodinamike u relativističko-kvantni opis međudjelovanja elementarnih čestica.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Stečeni ishodi učenja predmeta Klasična elektrodinamika i Kvantna fizika</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Nakon usvajanja gradiva od studenta se očekuje da zna:
– klasificirati temeljne čestice i sile u prirodi te navesti mase i vremena života čestica karakteričnih za pojedine interakcije;
– heuristički izvod Schrödingerove i Klein-Gordonove jednadžbe te pridružene jednadžbe kontinuiteta;
– izvesti Diracovu jednadžbu linearizacijom Klein-Gordonove jednadžbe;
– riješiti Diracovu jednadžbu za slobodnu česticu i demonstrirati poznavanje osnovnih svojstava Diracovih spinora;
– navesti sačuvane veličine pridružene zasebnim kontinuiranim prostornovremenskim simetrijama - Noetherin teorem;
– osnove Feynmanovog računa i primjenu na ABC teoriju;
– osnovne koncepte kvantne elektrodinamike i kromodinamike;
– osnovne koncepte slabih međudjelovanja i elektro-slabog ujedinjenja;
– objasniti baždarne teorije i Higgsov mehanizam;
– osnove fizika van Standardnog modela.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Uvod u fiziku čestica: kako proizvodimo i kako detektiramo čestice, povijesni razvoj fizike elementarnih čestica, Heavyside-Lorentzov sustav jedinica.
2. Dinamika elementarnih čestica: fundamentalne sile, kvantna elektrodinamika (QED), kvantna kromodinamika (QCD), slaba međudjelovanja, zakoni sačuvanja.
3. Relativistička kinematika: Lorentzove transformacije, sudari, sustav centra mase i laboratorijski sustav.
4. Eksperimentalne metode: akceleratori, međudjelovanje čestica i materije, detektori čestica, otkriće Higgsovog bozona.
5. Simetrije: translacije, rotacije, parnost, konjugacija naboja i inverzija vremena.
6. Feynmanov račun: raspadi i raspršenja, zlatno pravilo za raspade i raspršenja, ABC teorija.
7. Osnove kvantne elektrodinamike.
8. Osnove kvantne kromodinamike.
9. Osnove slabih međudjelovanja.
10. Elektro-slabo ujedinjenje.
11. Baždarne teorije i Higgsov mehanizam.
12. Fizika van Standardnog modela.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Pohađati barem 70% predavanja i 70% vježbi. Rješavati domaće zadaće</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 2 · Research: · Practical work:
Experimental work: · Paper:
Essay: · Seminar paper:
Colloquiums: 1 · Oral exam: 2
Written exam: 1 · Project:</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Položiti dva kolokvija koja se sastoje od zadataka i pitanja iz teorije s uspjehom barem 50% iz svakog kolokvija ili položiti završni ispit s uspjehom barem 50%</td></tr>
<tr><td>Required literature</td><td></td><td>Number of</td><td>Availability on</td></tr>
</table>

	Title	copies available	other medium
	Griffiths, David. Introduction to elementary particles 2nd Edition, 2008		
	Halzen, Francis, and Alan D. Martin. Quarks and Leptons: An Introductory Course in Modern Particle Physics, Wiley, 2010.		
	Martin, B. R., & Shaw, G. (2017). Particle physics. Chichester, West Sussex, United Kingdom: John Wiley & Sons, Ltd.		
Supplementary literature	Slideovi i bilješke s predavanja		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="7">Elementary Particle Physics II</td></tr>
<tr><td>ID</td><td>PMP234</td><td>Study year</td><td colspan="5">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Marko Kovač</td><td>Points value (ECTS)</td><td colspan="5">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td colspan="2">P</td></tr>
<tr><td>45</td><td>0</td><td>15</td><td colspan="2">0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="5">25%</td></tr>
<tr><td colspan="8">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="7">Stjecanje znanja i kompetencija iz fizike elementarnih čestica. Predmet objedinjuje znanja stečena u kolegijima kvantne mehanike i klasične elektrodinamike u relativističko-kvantni opis međudjelovanja elementarnih čestica.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="7">Stečeni ishodi učenja predmeta Fizika elementarnih čestica I.</td></tr>
<tr><td>Learning outcomes</td><td colspan="7">Nakon usvajanja gradiva od studenta se očekuje da zna:
– napisati Maxwellove jednadžbe u kovarijantnom obliku, navesti relativistički kovarijantni Lagrangian iz kojeg se postupkom varijacije mogu izvesti Maxwellove jednadžbe i demonstrirati poznavanje odgovarajućeg izvoda;
– navesti relativistički kovarijantni Lagrangian iz kojeg se postupkom varijacije mogu izvesti Klein-Gordonova i Diracova jednadžba te demonstrirati poznavanje odgovarajućeg izvoda;
– koncepte kvantne elektrodinamike (QED) i Feynmanova pravila za QED;
– opisati procese u drugom redu računa smetnje: Møllerovo raspršenje, Bhabhaino raspršenje, Comptonovo raspršenje, produkcija/anihilacija para te anihilaciju elektrona i pozitrona u mion i antimion.
– objasniti postupak dobivanja informacija o strukturi protona;
– opisati raspade miona, nabijenih piona, kaona i teških mezona;
– teoriju elektroslabog ujedinjenja;
– osnovne koncepte fizike neutrina;
– objasniti porijeklo masa u okviru Standardnog modela;
– opisati otkriće Higgsovog bozona.</td></tr>
<tr><td>Syllabus</td><td colspan="7">13. Varijacijski princip, Lagrangian Maxwellovog i Diracovog polja, Noether struje.
14. Učestalost raspada i udarni presjeci, Lorentz invarijantni fazni prostor.
15. Kvantna elektrodinamika: Feynmanova pravila i Casimirov trik.
16. QED procesi: Moelerovo raspršenje, Bhabhaino raspršenje, Comptonovo raspršenje i produkcija/anihilacija para.
17. Ostali QED procesi: Mottovo raspršenje i anihilacija elektrona i pozitrona.
18. Kvantna kromodinamika (QCD): zatočenje kvarkova, asimptotska sloboda, Feynmanova pravila, jetovi, elastični i neelastično raspršenje elektrona.
19. Slabe interakcije: V-A teorija, raspad miona, raspad nabijenog piona, raspadi kaona, raspadi teških mezona.
20. Elektroslabo ujedinjenje.
21. Fizika neutrina: oscilacije neutrina, neutrinske mase i miješanje u leptonskom sektoru.
22. Baždarne teorije i lokalna baždarna invarijantnost.
23. Porijeklo masa čestica Standardnog modela, Higgsov mehanizam u Standardnom modelu, mase baždarnih bozona, masa Higgsovog bozona.
24. Fizika van Standardnog modela.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="4">☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="2">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="7">Pohađati barem 70% predavanja i 70% vježbi. Rješavati domaće zadaće.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td colspan="2"></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Colloquiums</td><td>1</td><td>Oral exam</td><td>2</td><td></td><td colspan="2"></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="7">Položiti dva kolokvija koja se sastoje od zadataka i pitanja iz teorije s uspjehom barem 50% iz svakog kolokvija ili položiti završni ispit s uspjehom barem 50%.</td></tr>
</table>

Required literature	Title	Number of copies available	Availability on other medium
	Griffiths, David. Introduction to elementary particles 2nd Edition, Wiley, 2008.		
	Halzen, Francis, and Alan D. Martin. Quarks and Leptons: An Introductory Course in Modern Particle Physics, Wiley, 2010.		
	Martin, B. R., & Shaw, G. (2017). Particle physics. Chichester, West Sussex, United Kingdom: John Wiley & Sons, Ltd.		
Supplementary literature	Slideovi i bilješke s predavanja		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

Subject name	Ocean Physics I		
ID	PMP163	Study year	1.
Lecturer	doc. dr. sc. Žarko Kovač	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 15, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description

Subject goals	– gaining knowledge on basic dynamical and physical processes in the ocean – provide knowledge of equations describing the physical dynamics of the oceans – acquiring basic knowledge about the impact of physical on biological and chemical processes in the oceans
Enrolment requirements	– basics of physics – basics of mathematics – basics of fluid mechanics – basic programming
Learning outcomes	– knowledge of physical processes in the sea – knowledge of basic equations of physical oceanography – knowledge of boundary conditions – formulation of simple mathematical models in physical oceanography – introductory knowledge about the effect of physical on biological processes in the ocean – introductory knowledge of the transport of tracers by ocean currents
Syllabus	1. Non-inertial reference frame (2 hours of lectures) 2. Coriolis force (2 hours of lectures) 3. Inertial oscillations (4 hours of lectures) 4. Equations of motion (4 hours of lectures) 5. Geostrophic balance (4 hours of lectures) 6. Continuity equation (2 hours of lectures) 7. Energy conservation equation and equation of state (4 hours of lectures) 8. Boundary conditions (2 hours of lectures) 9. Interaction of light and sea water (4 hours of lectures)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☑ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☑ domaće zadaće ☐ ☐ ☐
Student obligations	Attend at least 70% of lectures and 70% of exercises.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper		Domaće zadaće	1
Essay		Seminar paper			
Colloquiums		Oral exam	2		
Written exam	1	Project			

Assessment and evaluation of student work	During the first 7 weeks of classes, students receive 5 homework assignments from the first 5 teaching units. These assignments are handed over at the end of the 8th week of classes. During the next 7 weeks of classes, students receive 5 new homework assignments from the last 4 teaching units. These assignments are handed over at the end of the 15th week of class. Students who submit assignments on time and achieve more than 50% of the possible points are exempted from taking the written part of the exam. Students who do not pass assignments or achieve less than 50% of the possible points must take a written exam. The final grade is formed on the basis of homework / exam (1/2 grade) and the answer to the oral exam (1/2 grade).

Required literature

Title	Number of copies available	Availability on other medium
Benoit Cushman-Roisin & Jean-Marie Beckers		

	Introduction to Geophysical Fluid Dynamics: Physical and Numerical Aspects Academic Press, 2007		
	Robert H. Stewart Introduction To Physical Oceanography Texas A & M University, 2000		
Supplementary literature	Steven Pond & George L. Pickard Introductory Dynamical Oceanography Butterworth-Heinemann, 1983 George L. Pickard & William J. Emery Descriptive Physical Oceanography: An Introduction Pergamon Press, 1982 Lynne D. Talley, George L. Pickard, William J. Emery, James H. Swift Descriptive Physical Oceanography: An Introduction Academic Press, 2011		
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Ocean Physics II		
ID	PMP268	Study year	1.
Lecturer	doc. dr. sc. Žarko Kovač	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 5, E: 15, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description	
Subject goals	– gaining knowledge on basic dynamical and physical processes in the ocean – acquiring knowledge of physical models describing ocean currents and wave motion – to introduce students to basic numerical methods for solving differential equations describing the physical dynamics of the ocean – gaining knowledge about more complex forms of motion in the ocean – to introduce students with to the concept of vorticity
Enrolment requirements	– Ocean Physics I – Introduction to Fluid Mechanics – programming
Learning outcomes	– basic knowledge about turbulence in the ocean – knowledge of basic forms of currents in the ocean and their physical causes – understanding different forms of wave motion in the ocean – introductory knowledge of numerical methods of discretization of equations of equations of motion – basic knowledge of ocean tides
Syllabus	1. Reynolds averaging (2 hours of lectures) 2. Turbulent cascade (2 hours of lectures) 3. Surface Ekman layer (4 hours of lectures) 4. Bottom Ekman layer (2 hours of lectures) 5. Wind currents in the oceans (6 hours of lectures) 6. Vorticity (2 hours of lectures) 7. Free waves (4 hours of lectures) 8. Shallow water equations and dynamics (4 hours of lectures) 9. Tides (2 hours of lectures) 10. Storm surge (2 hours of lectures)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☑ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☑ domaće zadaće ☐ ☐ ☐
Student obligations	Attend at least 70% of lectures and 70% of exercises.

Monitoring student work						
	Class attendance	1	Research		Practical work	
	Experimental work		Paper		Domaće zadaće	1
	Essay		Seminar paper			
	Colloquiums		Oral exam	2		
	Written exam	1	Project			

Assessment and evaluation of student work	During the first 7 weeks of classes, students receive 5 homework assignments from the first 5 teaching units. These assignments are handed over at the end of the 8th work in class and at the final exam week of classes. During the next 7 weeks of classes, students receive 5 new homework assignments from the last 4 teaching units. These assignments are handed over at the end of the 15th week of class. Students who submit assignments on time and achieve more than 50% of the possible points are exempted from taking the written part of the exam. Students who do not pass assignments or achieve less than 50% of the possible points must take a written exam. The final grade is formed on the basis of homework / exam (1/2 grade) and the answer to the oral exam (1/2 grade).

Required literature	Title	Number of copies	Availability on other medium

		available	
	Benoit Cushman-Roisin & Jean-Marie Beckers Introduction to Geophysical Fluid Dynamics: Physical and Numerical Aspects Academic Press, 2007		da
Supplementary literature	Jochen Kampf Ocean Modelling for Beginners Springer, 2009. Jochen Kampf Advanced Ocean Modelling Springer, 2009. Reza Malek-Madani Physical Oceanography: A Mathematical Introduction with MATLAB CRC Press, Taylor & Francis, 2012.		
	Rick Salmon Introduction to Ocean Waves Scripps Institution of Oceanography, 2018.		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Plasma Physics and Fusion Technology		
ID	PMP273	Study year	2.
Lecturer	prof. dr. sc. Dragan Poljak	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 45, S: 0, E: 30, P: 0
Subject status	Elective	Online percentage	0%

Subject description

Subject goals	Introduction to plasma physics and fusion technology aspects.
Enrolment requirements	Mathematics (Differential and integral calculus, differential equations), General physics (classical electromagnetics, fluid mechanics, thermodynamics).
Learning outcomes	1. Fundamental knowledge of plasma physics 2. Basic notions in fusion technology 3. Magnetohydrodynamics equations 4. Numerical methods for solving magnetohydrodynamics equations
Syllabus	Fundamentals of plasma physics. Microscopic and macroscopic definition of plasma, Themonuclear fusion and plasma confinement. (3h L+ 2h E) Mass conservation law and continuity equation (3h L+ 2h E) Equation of motions. Energy flow (3h L+ 2h E) Fundamental laws in electromagnetics, Basic concepts of electromagnetic field, Maxwell equations, Conservation law in electromagnetic field, (3h L+ 2h E) Magnetohydrodynamics fundamentals, Magnetohydrodynamics (MHD) equations, induction equation, motion equation, energy equation (3h L+ 2h E) Equilibrium in Magnetohydrodynamics. Simple configurations of MHD equilibrium; cylindrical geometry, toroidal geometry equilibrium, Grad-Shafranov equation. (3h L+ 2h E) Current diffusion equation. Transport equations (3h L+ 2h E) Analysis methods for the solution of MHD equations (3h L+ 2h E) Numerical methods for the solution of MHD equations (3h L+ 2h E) Application of finite difference method (3h L+ 2h E) Application of finite element method (3h L+ 2h E) Calculus of variations and ideal energy principle in MHD (3h L+ 2h E) Application of toroidal plasma , tokamak, nuclear reactor, controlled thermonuclear fusion (3h L+ 2h E) ITER and DEMO research (3h L+ 2h E) List of exercises Single particle modeling of plasma systems Analytical solution of plasma systems Analytical solution of motion equations Analytical solution of linear cylindrical configurations Analytical solution of Grad Shafranov equations Numjerical solution of Grad Shafranov equation via finite difference method Numjerical solution of Grad Shafranov equation via finite element method Analytical solution of diffusion equation Numerical solution of diffusion equation via finite difference method Numerical solution of diffusion equation via finite element method Analytical and numerical modeling of transport equations
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring
Student obligations	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.

Monitoring student work						
Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	2	Oral exam			
Written exam	2	Project			

Assessment and evaluation of student work	There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. Each midterm test (120 min in duration) consists of 3 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) where M1 and M2 are the midterm test results, and is determined through following percentage score: Percentage score:Grade: From 50% to 62% sufficient (2) From 63% to 75% good (3) From 76% to 88% very good (4) From 89% to 100% excellent (5) Students who do not pass midterm exams are obliged to pass final test (150 min in duration) in winter/fall examination period. Final test consists of 4 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is 50 % points. Final grade is formed according to the described procedure.The midterm and final exams are carried out as written tests.

Required literature	Title	Number of copies available	Availability on other medium
	D.D.Schnack: Lectures in Magnetohydrodynamics, Springer-Verlag, Berlin 2009		
	H. Goedbloed, S. Poedts, Principles of Magnetohydrodynamics, Cambridge University Press, New York, 2004		
	H. Goedbloed, S. Poedts, Advanced Magnetohydrodynamics, Cambridge University Press, New York, 2010.		
	D. Poljak, Teorija elektromagnetskih polja s primjenama u inženjerstvu, Šk. Knjiga Zagreb, 2014.		

Supplementary literature	[1] D. Poljak, Advanced Modeling in Computational Electromagnetic Compatibility, Wiley, New York, 2007.
Quality assurance	Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations
Other (in the opinion of the proponent)	

Subject name	Plant physiology						
ID	PMB034	Study year	3.				
Lecturer	prof. dr. sc. Valerija Dunkić	Points value (ECTS)	8.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			45	0	45	0	
Subject status	Compulsory	Online percentage	10%				
Subject description							
Subject goals							
Enrolment requirements							
Learning outcomes							
Teaching types	☑ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐				
Student obligations							
Monitoring student work	Class attendance	1	Research		Practical work		
	Experimental work	2	Paper				
	Essay		Seminar paper				
	Colloquiums	2	Oral exam	2			
	Written exam	1	Project				
Assessment and evaluation of student work							
Required literature	Title	Number of copies available	Availability on other medium				
	Pevalek-Kozlina, B. (2003) Fiziologija bilja. Sveučilišni udžbenik. Profil International, Zagreb.						
Supplementary literature	Taiz, L. and Zeiger, E. (2002): Plant Physiology. Sinnauer Ass. Inc. Sunderland, Massachusetts. Buchanan, B., Gruissem, W., and Jones, R. L. (2002): Biochemistry and Molecular Biology of Plants. John Wiley & Sons. Stryer, L. (1991): Biokemija. Školska knjiga, Zagreb.						
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split						
Other (in the opinion of the proponent)							

Subject name	Fourier Analysis and Applications		
ID	PMM820	Study year	2.
Lecturer	prof. dr. sc. Saša Krešić Jurić	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Elective	Online percentage	20%

Subject description

Subject goals	To introduce students to the fundamentals of Fourier series, Fourier transform and applications to signal processing.
Enrolment requirements	The student must have passed the following courses: Introduction to mathematical analysis, Mathematical analysis I and Linear algebra. The student must have taken the course Mathematical analysis II.
Learning outcomes	Knowledge of the fundamentals of Fourier series, computation of Fourier series and identifying different types of convergence of the series. Knowledge of basic properties of the Fourier transform and its applications to signal filtering and sampling.
Syllabus	1.Inner product spaces: inner product, Cauchy-Schwartz inequality, orthonormal systems, convergence in the norm, basis, Bessel's inequality, Parseval's relation. + 2.Fourier series: definition and computation of Fourier series, Fourier series of even and odd functions, complex Fourier series, pointwise convergence and Dirichlet's theorem, uniform converence, convergence in the mean. 3.Fourier transform: Fourier transform in L^1(R), basic properties of the Fourier transform, Riemann-Lebesgue lemma, convolution theorem, Fourier transform in L^2(R), Plancharel identity, inverse Fourier transform. 4.Applications to signal processing: linear filters, time-invariant filters, causal filters, low-pass filters, Shannon-Whittaker sampling theorem, uncertainty principle.
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Class attendance and taking partial and final exams.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	1	Oral exam	1		
Written exam	1	Project			

Assessment and evaluation of student work	Partial exams, written exam and oral exam.

Required literature

Title	Number of copies available	Availability on other medium
A.Pinkus, S.Zafrani, Fourier Series and Integral Transforms, Cambridge University Press, Cambridge, 1997.		

Supplementary literature	P. Bremaud, Mathematical Principles of Signal Processing: Fourier and Wavelet Analysis, Springer, New York, 2002.
Quality assurance	Student evaluations following completion of the course. The evaluations are administered according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Genetika i biotehnologija u agrikulturi		
ID	PMB547	Study year	2.
Lecturer	doc. dr. sc. Ivica Šamanić	Points value (ECTS)	4.0
Associates		Class execution (number of hours in semester)	L: 30, S: 10, E: 20, P: 0
Subject status	Elective	Online percentage	10%

Subject description	
Subject goals	Približiti temeljna znanja i praktične vještine za korištenje biotehnoloških metoda u oplemenjivanju biljaka u mediteranskom klimatskom području.
Enrolment requirements	Poznavanje osnova biologije stanice i botanike
Learning outcomes	procijeniti mogućnost praktične primjene različitih in vitro tehnika postizanja genetičke varijabilnosti kod različitih biljnih vrsta; koristiti osnovnu laboratorijsku opremu potrebnu za pripremu hranidbenih medija te rukovati kulturom biljnog tkiva u sterilnim uvjetima; procijeniti koristi i rizike genetski modificiranih (GM) biljaka; napisati laboratorijski izvještaj s prikazom dobivenih rezultata; prezentirati rezultate istraživanja u formi seminarskog rada
Syllabus	POPIS PREDAVANJA: 1. Jedinstvena genetička obilježja biljaka (Sposobnost fotosinteze, Totipotencija biljnih stanica, Mogućnost spolnog i nespolnog razmnožavanja, Dvostruka oplodnja, Poliploidija, Izmjena generacija, Mitoza u haploidnom stanju); 2. Organizacija i funkcija biljnog genoma (Biljna stanica sadrži tri neovisna genoma; Ponavljajuće sekvence u genomu, Organizacija jedinstvenih sekvenci, Evolucija ponavljajućih sekvenci u žitaricama, Organizacija kloroplastnog genoma, Organizacija mitohondrijskog genoma, Uređivanje RNA - engl.RNAediting); 3. Regulatorni mehanizmi u razvoju biljaka (Molekularni mehanizmi kojima endogeni i okolišni regulatorni čimbenici kontroliraju razvoj; poseban osvrt na percepciju podražaja i glavne događaje u signalnom lancu što dovode do usklađene ekspresije gena i staničnog razvoja); 4. Temeljni modeli nasljeđivanja (Mendelovi zakoni nasljeđivanja, Kromosomska teorija nasljednosti (Sutton-Boveri), Stanična i molekularna osnova nasljeđivanja fenomen dominacije, Citoplaznatsko i poligensko nasljeđivanje); 5. Interakcije među alelima i genima (Interakcije među alelima jednog gena: nepotpuna dominacija, kodominacija, letalni aleli, multipli aleli; Interakcije među alelima različitih gena: epistaza, pleiotropija, komplementarni geni, duplicirani geni); 6. Stanični odgovor za abiotički stres i biljne patogene (Ekspresija gena i prijenos signala kao odgovor na dehidraciju, Kontrola biljnih patogena genetskim inženjeringom); 7. Kromatin i genska ekspresija (Hetrokromatin i eukromatin, Modifikacije histona, Metilacija DNA); 8. Principi i tehnike oplemenjivanja biljaka (Načela i metode oplemenjivanja za poboljšanje usjeva, Alternativni pristupi kroz hibridizaciju i selekciju); 9. Metode genetske modifikacije biljaka (Transformacija biljaka pomoću bakterije Agrobacterium tumefaciens, Metode za provjeru integracije transgena u biljnom genomu); 10. Biljni genetski inženjering (Primjena biljaka u proizvodnji rekombinantnih proteina i antitijela); 11. Mapiranje biljnog genoma s molekularnim markerima (Molekularni biljezi u biljnoj biotehnologiji - morfološki, biokemijski i DNA vezani molekularni markeri, Identifikacija poželjnih genotipova u ranim generacijama molekularnim markerima); 12. Genetički mehanizmi reguliranja fertilnosti (Samo-inkompatibilnost i muška citoplazmatska sterilnost u biljnim kulturama i njihova komercijalna eksploatacija, Molekularna osnova samo-inkopatibilnosti); 13. Pokretni genetički elementi 14. Haploidne i triploidne biljke (Kultura mikrospora (androgeneza), Kultura makrospora (ginogeneza), Proizvodnja haploida i dihaploidizacija); 15. Kultura biljnog tkiva (Mikropropagacija, Načini regeneracije biljaka in vitro, Metode izolacije i fuzije protoplasta, Somaklonsko variranje); PRAKTIKUM:

<table>
<tr><td></td><td>Kontrolirano križanje transgenih biljaka arabidopsisa nositelja fuzijskih konstrukata
Hranjive podloge za in vitro uzgoj biljaka
Sterilizacija sjemenki
Izdvajanje genomske DNA iz biljnog tkiva
Genotipizacija jedinki pomoću tehnike lančane reakcije polimerazom (PCR) – Genotipizacija jedinki za konstrukte gena GUS
Histokemijska vizualizacija aktivnosti ß-glukuronidaze (GUS) u cijeloj biljci
SEMINAR; Dio nastave uključuje seminar. Studenti sami obrađuju originalni znanstveni rad tematski vezan uz nastavne cjeline te javno prezentiraju svoj rad (uključuje prezentaciju u Power Point programu te diskusiju). Cilj je osposobiti studenta da jasno formulira te kratko i koncizno prezentira znanstvenu problematiku (15 minuta), integrira znanje stečeno tijekom trajanja kolegija kroz kritičko razmišljanje i zaključivanje tijekom diskusije na temu seminarskog rada.</td></tr>
<tr><td>Teaching types</td><td>
<table>
<tr><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☑ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☑ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
</table>
</td></tr>
<tr><td>Student obligations</td><td></td></tr>
<tr><td>Monitoring student work</td><td>
<table>
<tr><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical work</td><td>0.5</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Laboratorijski izvještaj</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Assessment and evaluation of student work</td><td>Metode ocjenjivanja

• Pismeni ispit
Gradivo predmeta podijeljeno je na dvije cjeline koje studenti polažu preko parcijalnih pismenih ispita ili pak pristupanjem cjelokupnom ispitu na kraju semestra. Pismeni ispit se smatra položenim ukoliko studenti postignu najmanje 60% od ukupnog broja bodova.

• Laboratorijski izvještaj
Svi laboratorijski izvještaji moraju sadržavati potpuni i detaljni pregled eksperimentalnih postupaka, opis rezultata koji su popraćeni analizom i interpretacijom podataka.

• Prezentacija seminarskog rada
Studenti će morati pripremiti prezentaciju koja prikazuje pregled znanstvene problematike s kojom se bave. Prezentacija će biti ocijenjena prema sadržaju prezentacije (ključne riječi, kritički pregled literature, prezentacija znanstvenih rezultata), formatu, inovativnosti i jezičnoj kompetenciji.

Konačna ocjena se izvodi na temelju ukupnih bodova za pojedine kategorije vrednovanja.</td></tr>
<tr><td>Required literature</td><td>
<table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>Slater A., Scott N. W., Fowler M. R. (2008) Plant Biotechnology: the genetic manipulation of plants (second edition). Oxford University Press</td><td></td><td></td></tr>
<tr><td>Grotewold E., Chappell J., Kellogg E. A. (2015) Plant Genes, Genomes and Genetics. JohnWiley&Sons,Ltd.</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Supplementary literature</td><td>Jelaska, Sibila (1994). Kultura biljnih stanica i tkiva. Zagreb: Školska knjiga.
Andreja Abramovič Ristov (ur) (2007). Metode u molekularnoj biologiji. Institut Ruđer Bošković.
Ranabhatt, Hiru., Kapor, Renu. (2018). Plant Biotechnology.
Woodhead Publishing India Pvt. Ltd.
Odabrani znanstveni članci</td></tr>
<tr><td></td><td></td></tr>
</table>

Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

Subject name	Histologija		
ID	PMB020	Study year	2.
Lecturer	prof. dr. sc. Ivana Bočina	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description	
Subject goals	Usvajanje znanja o vrstama tkiva i njihove osobine, opisivanje, prepoznavanje i razumijevanje histološke građe tkiva, organa i organskih sustava, razumjeti međusoban odnos među tkivima te histološku i funkcionalnu povezanost tkiva unutar organa i organskih sustava, prepoznati vrste tkiva i organa na histološkom prerezu kroz tkiva i organe.
Enrolment requirements	Položen ispit iz Biologije stanice i Anatomije čovjeka.
Learning outcomes	Student će nakon položenog ispita moći: 1.protumačiti i objasniti osnovne pojmove u histologiji 2.opisati i objasniti histološku građu epitelnog, vezivnog, mišićnog i živčanog tkiva 3.kategorizirati tkiva i organe 4.razumjeti odnose među tkivima i organima 5.objasniti ustroj tkiva i njihovu povezanost unutar organa 6.znati razlikovati tkiva i organe na temelju njihove histološke građe na razini svjetlosnog mikroskopa
Syllabus	Predavanja i vježbe: 1-15 tjedana 1.Uvod. Metode mikroskopije. (2 sata) 2.Epitelno tkivo. (2 sata) 3.Vezivno tkivo. (2 sata) 4.Hrskavično i koštano tkivo. (2 sata) 5.Mišićno tkivo. (2 sata) 6.Živčano tkivo. (2 sata) 7.Krv i Krvožilni sustav. (2 sata) 8.Imunosni sustav. (2 sata) 9.Probavni sustav I (2 sata) 10.Probavni sustav II (2 sata) 11.Dišni sustav. (2 sata) 12.Mokraćni sustav. (2 sata) 13.Muški spolni sustav. (2 sata) 14.Ženski spolni sustav. (2 sata) 15.Endokrini sustav. (2 sata)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Pohađanje nastave predavanja i vježbi.

Monitoring student work

Class attendance	1.0	Research		Practical work	
Experimental work		Paper		Mikroskopiranje	1.0
Essay		Seminar paper			
Colloquiums	1.0	Oral exam	2.0		
Written exam		Project			

Assessment and evaluation of student work	Ispit se sastoji od pismenog i usmenog dijela. Gradivo predmeta podijeljeno je na dvije cjeline koje studenti polažu preko parcijalnih pismenih ispita ili pak pristupanjem cjelokupnom ispitu na kraju semestra. Pismeni ispit se smatra položenim ukoliko studenti postignu najmanje 60% od ukupnog broja bodova. Nakon položenog pismenog dijela student stiče pravo izlaska na usmeni dio ispita. Konačna ocjena formira se temeljem ocjena iz pismenog i usmenog dijela ispita. Bodovanje: <60% student nije zadovoljio; 60-70% dovoljan (2); 70-80% dobar (3); 80-90% vrlo dobar (4); 90-100% izvrstan (5).

Required literature		Number of	Availability on

	Title	copies available	other medium
	Junqueira L.C., Carneiro, J., Kelly R.O. (2005) Osnove histologije. Školska knjiga, Zagreb		
Supplementary literature	A.L. Kierszenbaum; L.L. Tres (2012) Histology and Cell Biology. An Introduction to Pathology. Elsevier, Saunder, Philadelphia. Mescher, A.L. (2013) Junqueira's Basic Histology. Text and atlas. McGraw Hill Companies, Inc. New York.		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="6">Human Computer Interaction:: Fundamentals and Principles</td></tr>
<tr><td>ID</td><td>PMIH30</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Andrina Granić</td><td>Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">25%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Acquisition of fundamental knowledge related to the interaction between human and computer, the importance of good user interface design, along with its role in effective communication between humans and interactive computer systems. Introduction to basic aspects and principles of usable and accessible design as well as design for good user experience. Acquisition of knowledge related to techniques and methods of usability and user experience evaluation.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">No formal prerequisites, but is assumed that students have already acquired basic knowledge about interactive computer systems</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. Name and explain fundamental terminology and concepts from the Human-Computer (HCI) field.
2. Critically evaluate selection of the principles for the design of usable and accessible user interface.
3. Explain the design for good user experience.
4. Compare and value different approaches to usability evaluation.
5. Decide on adequate methodology for user interface evaluation.
6. Use case: critically evaluate reasons for the development of interactive computer system (product, service); decide on the key functionality according to the set goals; apply principles of usable interface design; decide on and employ adequate evaluation approach.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Lectures:
1. Human-Computer Interaction (HCI): definitions and fundamental principles (2h)
2. Design of everyday things (2h)
3. Usability, accessibility and user experience (2h)
4. Short chronology on interface and interaction design (2h)
5. Human aspects of interaction (4h)
6. Modelling of human-computer interaction (2h)
7. Computer aspects of interaction (2h)
8. Invited lecture (2h)
9. Development of interactive computer systems (2h)
10. User interface design (2h)
11. Prototyping (2h)
12. User interface evaluation (4h)
13. Future interfaces and interactions (2h)
Exercises:
1. Introduction to course exercises - generally about structure of exercises; gained knowledge and skills; topics which will be covered; work flow; individual and group tasks; grading.
2. Psychology of everyday things - examples of usable and unusable design of everyday things; analysis of unnecessary design, design with potential and design with new purpose; emotional design; design of future
things; 1. Individual task for students (analysis of everyday things, usable and unusable design).
3. Presentations of the 1. Individual student tasks - analysis and discussion.
4. Role of the cognitive psychology - area of interest, influence on the Human Computer Interaction field; information processing; Model of Human Processor; user interface perception.
5. Cognitive “lab” - practical exercises in solving problems from the field of cognitive abilities (attention, perception, memory, learning, problem solving).
6. User interface usability - examples of web interfaces; usability testing methodology; 2. Individual task for students (interface usability analysis of the 3 web sites).
7. Presentations of the 2. Individual student tasks - analysis and discussion.
8. Introduction to group project - iteration procedure of designing web site interfaces; usability testing introduction; goal and methods; task description for preparing and conducting the testing; instructions for writing an usability report.</td></tr>
</table>

<table>
<tr><td></td><td>9. Allocation of tasks and web site interface for usability testing – group work.
10. Developing measurement instruments, questionnaires and questions for user interviews – group work.
11. Implementation of interface usability testing through 6 steps – group work.
12. Group presentations of conducted testing – analysis and discussion.
13. Defining necessary changes on web site interfaces – group work.
14. Implementation of necessary changes on web site interfaces – group work.
15. Group projects – final presentations of student projects.</td></tr>
<tr><td>Teaching types</td><td><table><tr><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☑ Laboratory
☑ Mentoring</td><td>☐
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☐
☐</td></tr></table></td></tr>
<tr><td>Student obligations</td><td>Active participation in all activities: lectures, consultations, searching the literature, individual work in the assigned project and given use case; final oral exam</td></tr>
<tr><td>Monitoring student work</td><td><table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td>2</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td>Individual /group projects (50%).
Final/Oral Exam (50%).</td></tr>
<tr><td>Required literature</td><td><table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>J. Preece, et al.: Human-Computer Interaction, Addison-Wesley, Harlow, England, 1994.</td><td>1</td><td></td></tr>
<tr><td>B. Schneiderman and C. Plaisant: Designing the User Interface. Strategies for Effective Human-Computer Interaction, 5th Edition, Addison-Wesley, Reading, MA, 2010.</td><td>1</td><td>on-line</td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td>1. S. Krug: Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability. 3rd Edition, New Riders, 2014.

2. J. Nielsen: Usability Engineering, Boston: AP Professional, 1993.

3. D. Norman: The Psychology of Everyday Things, Basic Books, 1988.

Svi nastavni materijali dostupni on-line, uključujući i dodatnu znanstvenu literaturu.</td></tr>
<tr><td>Quality assurance</td><td>student discussion, anonymous student evaluation questionnaire, student success rate, self-assessment</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td></td></tr>
</table>

Subject name	Research Project		
ID	PMP134	Study year	2.
Lecturer	doc. dr. sc. Marko Kovač	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 0 S: 30 E: 0 P: 0
Subject status	Elective	Online percentage	50%

Subject description

Subject goals	1. Train students for independent research. 2. Learn how to interpret and present research results. 3. Encourage independent research.
Enrolment requirements	Acquired learning outcomes of the following courses: 1. Special Theory of Relativity 2. Elementary Particle Physics I 3. Stochastic Simulations in Classical and Quantum Physics
Learning outcomes	1. Knowledge of making a physical model for a selected problem in Astrophysics and Elementary Particle Physics. 2. Knowledge of data analysis in Astrophysics and Elementary Particle Physics. 3. Knowledge of research planning . 4. Preparing a written seminar. 5. Oral presentation.
Syllabus	1. Definition of the research problem. 2. Literature research. 3. Collection and preparation of data. 4. Data analysis. 5. Presentation of research results. 6. Writing a seminar.
Teaching types	☐ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☑ Laboratory ☑ Mentoring
Student obligations	Regular consultations with the teacher. Regular reports by students on research progress.

Monitoring student work

Class attendance		Research	4	Practical work	
Experimental work		Paper			
Essay	1	Seminar paper			
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	Continuous monitoring of problem-solving progress. Evaluation of written summary and presentation of results.

Required literature

Title	Number of copies available	Availability on other medium
Depending on the research topic.		

Supplementary literature	Depending on the research topic.
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Research in Computational Physics I		
ID	PMP276	Study year	1.
Lecturer	doc. dr. sc. Željka Sanader Maršić	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 0, S: 20, E: 0, P: 0
Subject status	Elective	Online percentage	20%

Subject description

Subject goals	Osposobiti studente za izradu fizikalnih modela, programiranja i simulacija te drugih programskih aktivnosti, s ciljem rješavanja složenih problema u fizici i interdisciplinarno.
Enrolment requirements	Ishodi učenja preddiplomskog studija Fizike.
Learning outcomes	– istražiti, izraditi i prezentirati fizikalni model za odabrani problem u fizici ili interdisciplinarno – izraditi program ili prilagoditi postojeće složene programske pakete za odabrani problem – izvršiti simulaciju fizikalnog modela ili drugi oblik pokretanja odabranog programa – pripremiti seminar i prezentirati rad
Syllabus	1. Principi izrade fizikalnih modela 2. Izrada programskog paketa i prilagodba odabranih postojećih složenih programa u fizici 3. Simulacija odabranih programa 4. Vizualizacija procesa i rezultata 5. Povezivanje s mjerenjima i njihova provedba uz pomoć računala
Teaching types	☐ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring
Student obligations	Pripremiti fizikalni model za odabrani problem. Pripremiti program ili prilagoditi odabrane programske pakete Izvršiti simulacije ili druge oblike provođenja programa. Pripremiti i prezentirati seminarski rad.

Monitoring student work

Class attendance		Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums		Oral exam			
Written exam		Project	4		

Assessment and evaluation of student work	Priprema i prezentacija rada programa (100 %)

Required literature

Title	Number of copies available	Availability on other medium
Različiti programski paketi i upute		

Supplementary literature	
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Research in Biophysics</td></tr>
<tr><td>ID</td><td>PMP407</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Lucija Krce</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 10, S: 20, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">To train students towards independent research, with the participating in development, measurement, analysis and presentation of scientific projects in biophysics and bio-science.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">The learning outcomes of Bachelor programmes in physics, basic knowledge in molecular biology and biochemistry.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">On completion of this course a student should be able to:
1. Explore, develop and present a physical model for the selected problem in biophysics or interdisciplinary.
2. Depending on the research subject, get familiar with the techniques and methods applied in the biophysical or interdisciplinary research.
3. Prepare and present a seminar work.
4. Develop a critical understanding of scientific investigation in biophysics and interdisciplinary and ability to describe and present such research.</td></tr>
<tr><td>Syllabus</td><td colspan="3">The course depends on the research subject, with the general content:
1. Definition of a research problem
2. Literature search
3. Definition of a physical model
3. Measurements, simulations, bioinformatical analysis, programming ...
4. Analysis and calculation
5. Writing seminar
6. Presentation</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☑ Mentoring
☑ Aktivni rad studenata, uz stručno vođenje.
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Independently, with the professional guidance, to complete and present small scientific project.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Samostalna mjerenja, analiza i prezentiranje rada</td><td>4</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Preparation and presentation of the research (100%).</td></tr>
<tr><td>Required literature</td><td colspan="3"><table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Depending on the choice of the research subject</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3">1. Analysis of the acquired learning outcomes at the end of the class, compared with the introductory work of students.
2. Monitoring the development of students in the subjects who followed the links</td></tr>
</table>

	with the success of the case. 3. Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Research in Environmental Physics</td></tr>
<tr><td>ID</td><td>PMP26C</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Žarko Kovač
izv. prof. dr. sc. Jadranka Šepić</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 10 | S: 20 | E: 30 | P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">– train students for independent research
– acquire skills of presentation of scientific results according to the standards of the profession
– encouraging independent research</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">– Introduction to Fluid Mechanics
– Meteorology I
– Ocean Physics I
– Introduction to Data Analysis
– Meteorology II
– Ocean Physics II</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">– knowledge of making a physical model for a selected problem in environmental physics
– knowledge of research planning
– depending on the choice of research topic, knowing specific techniques and Methods of measurement and data processing
– depending on the choice of research topic, knowing specific techniques and modelling methods
– preparing a written seminar
– oral presentation</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Review of current research in environmental physics (10 hours of lectures)
2. Definition of the research problem (*)
3. Literature search (*)
4. Analysis of the theoretical model (*)
5. Presentation of the theoretical foundations of the research topic (10 hours of seminars)
6. Measurements, simulations, development of computer programs (*)
7. Analysis and data processing (*)
8. Presentation of quantitative research results (10 hours of seminars)
9. Writing a seminar (*)
* The exact number of hours of practice of each teaching unit depends on the research topic.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☑ Combined online</td><td>☑ Fieldwork
☑ Individual assignments
☑ Multimedia
☑ Laboratory
☑ Mentoring</td><td>☑ Homework
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attend at least 70% of lectures and 70% of exercises.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td>0.5</td></tr>
<tr><td>Experimental work</td><td>0.5</td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td>2</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">For the first 5 weeks, the teacher gives lectures on current research topics in environmental physics (models, measurements, instrumentation). By the end of the 5th week of classes, the student chooses a topic and a mentor. Depending on the topic, the student also receives a co-mentor who can be from an external institution. In weeks 6 – 15, the student conducts research by attending individualized exercises adapted to the research topic. At the end of week 10, he presents the theoretical foundations of the research topic. At the end of week 15, the student presents the quantitative results of the research. He then submits a written seminar containing</td></tr>
</table>

	theory and results. Students who do not present theoretical or quantitative results, or do not submit a seminar, lose the right to take the exam.		
Required literature	Title	Number of copies available	Availability on other medium
	– books depending on the research topic		
Supplementary literature	– papers depending on the research topic		
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Research in Computational Physics II</td></tr>
<tr><td>ID</td><td>PMP277</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Ivana Weber</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 5, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>50%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Samostalno provedeno istraživanje, koje uključuje primjenu neke od metoda računarske fizike. Razvoj sposobnosti vizualizacije, kritičke evaluacije i prezentacije dobivenih rezultata.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Osnove programiranja.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Nakon položenog predmeta student bi trebao:
–Kritičko vrednovati teorije, podatke i rezultate numeričkih proračuna.
– Primijeniti i prilagoditi neku od naprednih metoda računarske fizike na rješavanje novih i složenih problema
– Formulirati i oblikovati rezultate istraživanja
– Prezentirati rezultate svog istraživačkog rada.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Definiran je temom istraživačkog projekta. Studentima će se prezentirati odabrane napredne metode računalne fizike te prezentirati ponuđene teme istraživanja. Nakon samostalnog rada i konzultacija s nastavnikom studenti će prezentirati rezultate svojih istraživanja.</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☑ Combined online
☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☑ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Pohađanje nastave. Samostalno provođenje istraživanja uz konzultacije s nastavnikom i priprema seminarskog rada. Prezentacija rezultata rada.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 0.2; Research: 4.3; Practical work: ; Experimental work: ; Paper: ; Essay: ; Seminar paper: 0.5; Colloquiums: ; Oral exam: ; Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Ocjena će biti određena na temelju vrednovanja rezultata dosegnutih u istraživačkom radu</td></tr>
<tr><td>Required literature</td><td colspan="3">Title: Znanstveni članci (ovisno o tematici projekta); Number of copies available: ; Availability on other medium: Online baze podataka</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Redovito praćenje napretka studenta u projektu.
Ankete.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Chemistry Education Research		
ID	PMC311	Study year	2.
Lecturer	dr. sc. Roko Vladušić, v. pred.	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 15, S: 15, E: 0, P: 0
Subject status	Elective	Online percentage	20%

Subject description

Subject goals	The goal of the course is to introduce Chemistry Education research. The focus is on the specific elements of research (recognition of the problem, research questions, methodology, instruments...) and specific problems related to teaching and learning Chemistry. The aim is to prepare pre-service chemistry teachers for tomorrow's questioning of their own chemistry instruction in scientific way.
Enrolment requirements	There are no prerequisites for enrolment in the course; starting competencies are related to Pedagogical Content (Chemistry) Knowledge.
Learning outcomes	After fulfilling all obligations, students will be able to: – differ types of research, – search databases, – plan research in chemistry education area, – choose adequate research approach, – set research question, – create research instrument, – conduct simple research in chemistry education area, – present the research
Syllabus	Lectures 1. The ways (methods) of comprehending the world 2. Scientific and unscientific approaches to the cognition 3. Theories and research 4. Research approaches 5. Research frameworks 6. Basic elements of research process 7. i 8. Writing scientific paper and research report 9. Research project 10. Preparation of written, oral and poster presentation of the research results 11. – 15. Review and analysis of scientific journals and selected papers from the field of chemistry education. Seminars 1. – 10. Analysis of chemistry education scientific papers 11. – 13. Research instrument design 14. – 15. Research plan preparation
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	To attend classes; to accomplish individual tasks.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper		Research plan preparation	0.5
Essay		Seminar paper	0.5		
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	Scientific paper analysis – 40 % Development of the research instrument – 20 % Research plan development – 40 % Students dissatisfied with achievement are free to approach to the oral exam.

Required literature

Title	Number of copies available	Availability on other medium

	Milas, G. (2009). Istraživačke metode u psihologiji i drugim društvenim znanostima, Naklada Slap.		
	Silobrčić, V. (2003). Kako sastaviti, objaviti i ocijeniti znanstveno djelo. Medicinska naklada, Zagreb.		
Supplementary literature	1.Bodner, G. M., Orgil, M. (2007). Theoretical Frameworks for Research in Chemistry/Science Education, Pearson Prentice Hall. 2.Bunce, D., M. and Cole, R., S. (2008). Nuts and Bolts of Chemical Education Research, American Chemical Society.		
Quality assurance	Internal evaluation of learning outcomes achievement; institutional evaluation at the end of the semester.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Izolacija fitonutrijenata</td></tr>
<tr><td>ID</td><td>PPC310</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Renata Odžak</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 0, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">usvajanje znanja o različitim vrstama prirodnih spojeva kao fitonutrijenata, njihovim strukturnim karakteristikama i biološkoj aktivnost te ovladavanju laboratorijskim tehnikama u izolaciji i identifikaciji istih.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Položena Opća kemija I i Opća kemija II, odslušana Organska i Analitička kemija.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Student će nakon položenog ispita moći:
1.usporediti i razlikovati različite skupine spojeva kao fitonutrijente
2.ispitati njihovu biološku aktivnost
3.predvidjeti mogućnost nekih drugih izolacijskih tehnika istih
4.izabrati neku drugu opciju ili metodu identifikacije istih</td></tr>
<tr><td>Syllabus</td><td colspan="3">Predavanja
1.Fitonutrijenti-definicija pojma i podijela sitih spojeva na glavne skupine (4 sata)
2.Alkaloidi (tanini, kafein...) osnove izolacije kafeina i njegova identifikacija (4 sata)
3.Flavonoidi - osnove izolacije klorofila iz blitve i beta-karotena iz mrkve (4 sata)
4.Vitamini (topljivi i netopljivi u vodi), utjecaj povišene temperature na iste (3 sata)
Laboratorijske vježbe:
1.Izolacija i identifikacija kafeina iz listića zelenog čaja (4 sata)
2.Izolacija i identifikacija klorofila iz blitve (4 sata)
3.Izolacija i identifikacija beta-karotena iz mrkve (4 sata)
4.Standardizacija vitamina C, određivanje vitamina C u soku i utjecaj temperature na isti (3 sata).</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Pohađanje nastave</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1 | Research: | Practical work:
Experimental work: | Paper: 0.5
Essay: | Seminar paper:
Colloquiums: | Oral exam: 0.5
Written exam: | Project:</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">50% referat, 50% usmeni ispit</td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
R. Odžak, nastavni materijal za predavanja na Moodle-u | |
R. Odžak, Interna skripta za laboratorijske vježbe | |</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Donald L. Pavia, Gary M. Lampman, George S. Kriz & Randall G. Engel, Introduction to Organic Laboratory Techniques, 2nd edition, Brooks/Cole-Thomson Learning, Belmont, USA, 2006.
Meskin, M.S., Bidlack, W.R., Davies, A.J., Omaye, S.T., Phytochemicals in Nutrition and Health, CRC Press, New York, 2000.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3">Za laboratorijske vježbe kvaliteta laboratorijskog dnevnika i referata, anonimne studentske ankete, konzultacije sa studentima.</td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Extracurricular Activities</td></tr>
<tr><td>ID</td><td>PMS173</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Anna Alajbeg
Antonija Bašić, pred.</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">To become aware of the importance of extracurricular activities to develop children's interests, the satisfaction of their personal needs and motivations, and the possibilities of professional guidance.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Pedagogy (79121) and Didactics (79107) passed</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Qualification for planning, programming and implementation of extracurricural activities
2. Perceiving dispositions potential and possible talents
3. To qualify for monitoring and evaluation of students' achievements and inclination
4. The understanding of the essence of free creative work and the characteristics of gifted pupils</td></tr>
<tr><td>Syllabus</td><td colspan="3">1.Etymologically and contents related concepts 2. Causes, reasons and conditions of introducing extracurricular activities 3. Functions of extracurricular activities 4. Tasks of extracurricular activities 5. The principles of the organization of extracurricular activities 6. Types of extracurricular activities regarding the content 7. Organizing embodiments of extracurricular activities 8-9. Creativity 10/11. Creativity and thinking 12-13. The creative act - the processes and dimensions 14./15.Creativity and education</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Class attendance, preparation and presentation of the seminar paper, preliminary exams or an exam.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Class attendance, activity, the quality of seminar paper presentation, the results of preliminary exams, exam results.</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Previšić, V. (1987.): Izvannastavne i izvanškolske aktivnosti. Školske novine, Zagreb.</td><td></td><td></td></tr>
<tr><td>Suhodolski, B. (1989.): Permanentno obrazovanje i stvaralaštvo. Školske novine, Zagreb.</td><td></td><td>dostupno</td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Težak, S. (1979.): Ciljevi, načela, sadržaji, oblici i metode rada u slobodnim aktivnostima jezično-izražajne umjetnosti. Suvremena metodika nastave hrvatskog ili srpskog jezika, Zagreb.
Težak, S. (1979.): Literarne, novinarske, recitatorske i srodne družine. Školske novine, Zagreb</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Consultations, discussion, active participation, evaluation.</td></tr>
<tr><td>Other (in the opinion of the</td><td colspan="3">* Seminar papers are presented in seminar groups (15x1 per group) and</td></tr>
</table>

proponent)	they represent the production of an extracurricular activity programm from the major field of study.

<table>
<tr><td>Subject name</td><td colspan="3">Language Culture</td></tr>
<tr><td>ID</td><td>PMS104</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Anđela Milinović Hrga</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Students repeat and expand the fundamental grammar knowledge of the Croatian language; they are introduced with lexicology and functional styles of the Croatian Standard; they systematize their linguistic knowledge.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. to correlate and analyze orthographic, orthoepic, grammatical, lexical and stylistic norms of the Croatian Standard
2. to critically examine language phenomena in contemporary Croatian language and to solve language problems
3. to differentiate functional styles and correctly use them in Standard Croatian
4. to apply the acquired language skills to improve one's oral and written communication
5. to perceive the value of language culture in practice and to raise awareness of the need for cultivating personal language expression
6. to use linguistic literature competently</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Language and speech. Language culture and speech culture. The functions of language. 2. Croatian language and Croatian standard language. 3. Multi-functionalism of the Croatian standard language. 4. Linguistic style and text editing. 5. Orthoepic and orthographic norms. 6. Grammatical norms. 7. Morphological issues: grammatical category, declension, conjugation. 8. Syntax and norm. 9. Functional styles and syntax. 10. The lexical structure of the Croatian Standard: stratification of the lexicon, linguistic borrowing, use and stylistic value of lexemes. 11. Foreign words, loanwords and adopted lexemes in the Croatian language: the use and adaptation to Croatian language system. 12. Professional terminology: the creation and standardization. 13. Word formation: theoretical and normative issues. 14. Word formation issues. 15. Word Formation and orthographic norm.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Class attendance.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance; Experimental work; Essay; Colloquiums; Written exam; Research; Paper; Seminar paper; Oral exam; Project; Practical work</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The presence in classes, active participation in classes, seminar work, colloquium.
Written exam (if the student does not pass the preliminary exams) with the possibility of an oral exam.</td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
-</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Orthographic editions:
Vladimir Anić, Josip Silić, Pravopis hrvatskoga jezika, Novi Liber - Školska knjiga, Zagreb, 2001.</td></tr>
</table>

	Stjepan Babić, Božidar Finka, Milan Moguš, Hrvatski pravopis, Školska knjiga, Zagreb, 1990 (pretisak izdanja iz 1971.); promijenjena izdanja: 21994, 31995, 41996. Stjepan Babić, Božidar Finka, Milan Moguš, Hrvatski pravopis, Školska knjiga, Zagreb, 52000 (V., prerađeno izdanje). Stjepan Babić, Božidar Finka, Milan Moguš, Hrvatski pravopis, Školska knjiga, Zagreb, 62002, 72003, 82004. Stjepan Babić, Milan Moguš, Hrvatski pravopis: usklađen sa zaključcima Vijeća za normu hrvatskoga standardnog jezika, Školska knjiga, Zagreb, 12010, 22011. Stjepan Babić, Sanda Ham, Milan Moguš, Hrvatski školski pravopis, Školska knjiga, Zagreb, 2005. Stjepan Babić, Sanda Ham, Milan Moguš, Hrvatski školski pravopis: usklađen sa zaključcima Vijeća za normu hrvatskoga standardnog jezika, Školska knjiga, Zagreb, 22008, 32009, 42112. Lada Badurina, Ivan Marković, Krešimir Mićanović, Hrvatski pravopis, Matica hrvatska, Zagreb, 12007, 22008. Hrvatski pravopis Instituta za hrvatski jezik i jezikoslovlje, Zagreb, 2013., dostupno i na pravopis.hr Grammars Barić, E. i sur.: Hrvatska gramatika, Školska knjiga, Zagreb, 1995. Ham, S: Školska gramatika hrvatskoga jezika, Školska knjiga, Zagreb, 2002. Silić, J., Pranjković, I.: Gramatika hrvatskoga jezika za gimnazije i visoka učilišta, Školska knjiga, Zagreb, 2005. Težak, S., Babić, S.: Gramatika hrvatskoga jezika. Priručnik za osnovno jezično obrazovanje, Školska knjiga, Zagreb, 1992. Dictionaries: Rječnik hrvatskoga jezika, ur. Jure Šonje, Leksikografski zavod „Miroslav Krleža“ i Školska knjiga, Zagreb, 2000. Klaić, B.: Rječnik stranih riječi, Nakladni zavod Matice hrvatske, Zagreb, 1981. www.hjp.srce.hr Language handbooks, language advisors, journals Katičić, R. (1986.). Novi jezikoslovni ogledi, Školska knjiga, Zagreb. Kovačević, M. (1998.), Hrvatski jezik između norme i stila, Nakladni zavod Globus, Zagreb. Mihaljević, M. (1993.). Hrvatsko računalno nazivlje, Hrvatska sveučilišna naklada, Zagreb. Oraić Tolić, D. (2011.). Akademsko pismo: Strategije i tehnike klasične retorike za suvremene studentice i studente, Naklada Ljevak, Zagreb. Škiljan, D. (2000.). Javni jezik, Antibarbarus, Zagreb. Težak, S. (2004.). Hrvatski naš (ne)podobni, Školske novine, Zagreb. Težak, S. (1995.). Hrvatski naš osebujni, Školske novine, Zagreb. Jezik, časopis za kulturu hrvatskoga književnog jezika, Hrvatsko filološko društvo, Zagreb. http://hrcak.srce.hr/index.php?show=casopisi_podrucje&id_podrucje=49 (the central portal of Croatian scientific journals, the field of philology) http://www.facebook.com/pages/Casopis-Jezik/113657748671600 http://soundcloud.com/ecipecireci http://jezicnisavjetnik.mojblog.hr http://nepismeni.bloger.hr http://savjetnik.ihjj.hr, language advice by the Institute of Croatian language and linguistics http://rnz.hrt.hr/index.php (1. program Hrvatskoga radija, emisija Govorimo hrvatski)
Quality assurance	Consultation, discussion, active participation, peer evaluation.
Other (in the opinion of the proponent)	No

<table>
<tr><td>Subject name</td><td colspan="3">Kemija ugljikohidrata u prehrani</td></tr>
<tr><td>ID</td><td>PPC311</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Renata Odžak</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Studenti će usvojiti znanja iz strukture, sinteze i funkcije različitih vrsta ugljikohidrata
prisutnih u hrani.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Položena Opća kemija 1 i 2 te upisana Organska kemija 1 i 2</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Student će nakon položenog ispita moći:
1. klasificirati ugljikohidrate
2. objasniti cikličku strukturu monosaharida
3. definirati mutorotaciju, okarakterizirati anomere
4. razlikovati modele ugljikohidrata (strukturno i stereokemijski)
5. interpretirati različite veze u glikozidima</td></tr>
<tr><td>Syllabus</td><td colspan="3">Predavanja
1. Uvod u kemiju ugljikohidrata- definicija, njihova važnost i podjela, Monosaharidi (struktura, nomenklatura stereokemija, anomerni C atom) (2 sata)
2. Fischerove projekcijske formule, D- i L- šećeri), hemiacetali i hemiketali, epimeri (2 sata)
3. Ciklički oblici ugljikohidrata (odnos Haworthove formule i konformacijski prikaz), ciklički prikaz glukoze, fruktoze, galaktoze (4 sata)
4. Konformacije monosaharida, (anomerni efekt), Mutorotacija (2 sata)
5. Reakcije monosaharida (redukcija u alditole, oksidacija u aldonske kiseline, oksidacija monosaharida sa slabim oksidansima) (4 sata)
6. Glikozidi (struktura, O-, S- N-glikozidi, prirodni glikozidi, nastajanje i hidroliza glikozida) (4 sata)
7. Disaharidi (reducirajući i nereducirajući šećeri, saharoza, laktoza, maltoza), Polisaharidi (celuloza, škrob, glikogen, amiloza, kitin- strukturne karakteristike i biološka svojstva) (4 sata)
8. Amino šećeri, (sinteze i svojstva) Deoksi šećeri (sinteza i svojstva), Analiza ugljikohidrata (4 sata)
9. Zaštitne skupine kod ugljikohidrata (4 sata)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Aktivno sudjelovanje na predavanjima.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper:
Colloquiums: ; Oral exam: 1
Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Usmeni način polaganja ispita.</td></tr>
<tr><td>Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td></td><td>Food carbohydrate Chemistry, R. E. Wrolstad, WileyBlackwell, 2012. 2)</td><td></td><td></td></tr>
<tr><td></td><td>Monosacharide chemistry, R. J. Ferrier and P. M. Collins, Penguin Books, Harmondsworth, 1972.</td><td></td><td></td></tr>
</table>

Supplementary literature	Essenrials of carbohydrate Chemistry and biochemistry, T. K. Lindhosrst, Wiley-VCH, 2003. Organic chemistry, P.Y. Bruice, Pearson Prentice Hall, 2006.
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Kinesiological activity, fitness and health</td></tr>
<tr><td>ID</td><td>PMS135</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Mladen Hraste</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 0, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The first objective of the course is to help students in understanding and implementation of a healthy way of life. Another goal of the course to over kinesiology operators maintain and improve their health and raise their quality of life and study</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">There are no requirements for subject enrolling.
There are no entry competences required.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After completing the course students will be capable:
o to implement independent participation in fitness programs
o to implement physically active lifestyle
o to apply learned knowledge and skills needed for further independent learning and the acquisition of new motor competence
o to promote the value of an active and healthy lifestyle
o better mental and physical health</td></tr>
<tr><td>Syllabus</td><td colspan="3">1st teaching topic (2 hours of lectures): concept and definition of kinesiology; development and structure of kinesiology
2ndt teaching topic (2 hours of lectures): equation specifications in sports
3rd teaching topic (2 hours of lectures): kinesiological activity and health
4th teaching topic (2 hours of lectures): review of scientific research on the effects of kinesiology to human health
5th teaching topic (2 hours of lectures): program of contemporary aerobics
6th teaching topic (2 hours of lectures): cardio fitness program
7th teaching topic (3 hours of lectures: weight fitness program
8th teaching topic (2 hours of exercises): program of contemporary aerobics (pilates)
9th teaching topic (2 hours of exercises): program of contemporary aerobics (aerobic)
10th teaching topic (2 hours of exercises): cardio fitness program (manual i fat burn program)
11th teaching topic (2 hours of exercises): cardio fitness program (high intensity interval training)
12th teaching topic (2 hours of exercises): weight fitness program for low extremities
13th teaching topic (2 hours of exercises): weight fitness program for hands and shoulders
14th teaching topic (3 hours of exercises): weight fitness program for trunk</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Students are required to attend a minimum of 24 out of 30 planned hours (80%).</td></tr>
</table>

Monitoring student work					
Class attendance	0.75	Research		Practical work	0.75
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam	0.5	Project			

<table>
<tr><td>Assessment and evaluation of student work</td><td>The course is rated as the arithmetic mean score of the practical exam and the theoretical exam.
The student will get a grade excellent (5) of the practical part of the exam if motor movement performed flawlessly, easily and harmoniously.
The student will get a grade very good (4) of the practical part of the exam</td></tr>
</table>

	if motor movement performed flawlessly, easily and harmoniously, but a little "harder". Students will get a good grade (3) of the practical part of the exam if motor movement performed with minor errors and with less difficulty. The student will get a grade sufficient (2) of the practical part of the exam if motor movement performed with major mistakes and with great difficulty. Students will receive an unsatisfactory grade (1) of the practical part of the exam if you can not perform a motor task is not in the elemental form. The theoretical part is taken by written test		
Required literature	Title	Number of copies available	Availability on other medium
	http://www.pmfst.hr/~mhraste/ Priručnik iz kolegija Kineziološka aktivnost, fitness i zdravlje		dostupno
Supplementary literature	Delavier F. (2009). Anatomski vodič za vježbe snage. Medicinska naklada, Zagreb. Milanović i sur. (1996). Fitness. Fakultet za fizičku kulturu Sveučilišta u Zagrebu, Zagrebački velesajam, Zagrebački športski savez, Fakultet za fizičku kulturu. Mišigoj–Duraković M. i sur. (1999). Tjelesno vježbanje i zdravlje. Fakultet za fizičku kulturu Sveučilišta u Zagrebu. Mraković M. (1993). Osnove sistematske kineziologije. Priručnik za sportske trenere (ur. Milanović D., Kolman M.). Fakultet za fizičku kulturu, Hrvatski olimpijski odbor, Zagrebački sportski savez. Sharkey, B. J. ; Gaskill, S. E. (2008). Fitness and health. Vežbanje i zdravlje. Beograd: Subcom.		
Quality assurance	Internal and external expert evaluation. Student evaluation.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="7">Clasical Mechanics</td></tr>
<tr><td>ID</td><td>PMP116</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Željana Bonačić Lošić</td><td>Points value (ECTS)</td><td colspan="4">8.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>45</td><td>0</td><td>45</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Develop the student commpentences in theoretical mechanics that are useful for further studies and application in their area of expertise.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6"></td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Student should be able to correctly state and apply the basic concepts and laws of theoretical mechanics. Construction of Lagrange function. Derivation and solving Lagrange equations. Transition from Lagrange's formalism to Hamilton's formalism. Explanation of the incompressibility of the phase space. Apply mathematical knowledge in physics.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Newton's laws 12. Lagrange's formalism 30. Homogeneity and isotropy of the space, homogeneity of time and conservation laws 10. Small vibrations 12. Normal coordinates 4. Dynamic of the rigid body 10. Hamilton’s formalism 10. Phase space 1. Liuoville's theorem 1.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="3">☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="2">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6"></td></tr>
<tr><td rowspan="5">Monitoring student work</td><td colspan="6">

Class attendance	3	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam	3		
Written exam	2	Project			

</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Preliminary exams. Written exam. Oral exams.</td></tr>
<tr><td>Required literature</td><td colspan="6">

Title	Number of copies available	Availability on other medium
H. Goldstein, Classical Mechanics, Wiley, New York, 1950	4	

</td></tr>
<tr><td>Supplementary literature</td><td colspan="6">L. D. Landau i E. M. Lifsic, Mehanika, Nauka, Moskva, 1979.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="7">Classical Mechanics I</td></tr>
<tr><td>ID</td><td>PMP110</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Željka Sanader Maršić</td><td>Points value (ECTS)</td><td colspan="4">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>45</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">30%</td></tr>
</table>

Subject description

Subject goals	Formulation of the laws of classical mechanics with the development of mathematical methods for solving problems and critical assessment of their applicability to classical systems.
Enrolment requirements	Mechanics (passed) Mathematics I (passed) Mathematics II (attended)
Learning outcomes	1. Interpret and apply the fundamental principles of classical mechanics, which includes Newton's determinism, Galilean invariance, and laws of conservation of momentum, angular momentum, and energy. Use vector calculus to solve basic problems in classical mechanics. 2. Apply Newton's postulates by solving differential equations. Explain what are inertial and non-inertial reference frames. 3. Derive the equation of motion of a particle in a non-inertial frame, describe the influence of each term on the particle's motion, and analyze the impact of Coriolis force on the motion of objects close to the Earth's surface. 4. Sketch possible trajectories of a particle in the field of any central force and derive the analytical expression for the particle's trajectory in the field of several well-known central forces, including Kepler's problem. Describe the scattering experiment on a fixed target with emphasis on Rutherford's experiment. 5. Qualitatively and quantitatively analyze the motion of particle systems, different types of harmonic oscillators (explain the phenomenon of resonance), and rigid bodies (derive Euler's equations, define Euler angles, solve the problem of symmetric and asymmetric oscillations, derive the expression for the inertia tensor, and calculate it for several regular geometric bodies).
Syllabus	1. (3+2) Scalars, Vectors, and Tensors 2. (3+2) Kinematics 3. (3+2) Newtonian Mechanics 4. (3+2) Mechanics of Particle Systems 5. (3+2) Motion in One Dimension 6. (3+2) Non-inertial Frames 7. (3+2) Central Forces 8. (3+2) Particle Scattering in a Central Force Field, 1/2 9. (3+2) Particle Scattering in a Central Force Field, 2/2 10. (3+2) Multipole Expansion of the Gravitational Potential 11. (3+2) Two-Body Problem 12. (3+2) Three-Body Problem and Lagrange Points 13. (3+2) Orthogonal Transformations 14. (3+2) Kinematics of Rigid Bodies 15. (3+2) Euler's Equations and Angles

Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐
Student obligations			

<table>
<tr><td rowspan="3">Monitoring student work</td><td>Class attendance</td><td>2.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

	Essay		Seminar paper			
	Colloquiums		Oral exam	1.75		
	Written exam	1.75	Project			

Assessment and evaluation of student work	Twice during the semester, students take a written exam covering two halves of the material. Students who score more than 50% on each exam are exempt from taking the written exam and can proceed to the oral exam. Students who score 50% or more on the first written quiz can take the oral exam in two parts, immediately after the written exam is graded. The final grade is based on the written exam (worth 1/2 of the grade) and the performance on the oral exam (worth 1/2 of the grade).

Required literature	Title	Number of copies available	Availability on other medium
	Herbert Goldstein, John Safko, Charles Poole: Classical Mechanics, Pearson New International Edition, Pearson; 3rd edition (July 25, 2013)	3	no
	David Morin: Introduction to Classical Mechanics: With Problems and Solutions, Cambridge University Press; 1st edition (February 4, 2008)	4	no

Supplementary literature	Slides and lecture notes.
Quality assurance	1. Teachers who have correlated learning outcomes collaborate and jointly ensure the quality of teaching. 2. Statistical analysis of exam results and evaluation of success in accordance with the stated learning outcomes. 3. Student evaluation through an anonymous survey conducted in accordance with the regulations of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Classical Mechanics II</td></tr>
<tr><td>ID</td><td>PMP111</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Marko Kovač</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 45, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Formulation of the laws of classical mechanics with the development of mathematical methods for solving problems and critical assessment of their applicability to classical systems.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Mechanics (passed)
Mathematics I (passed)
Mathematics II (attended)
Classical Mechanics I (attended)</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Formulate D'Alambert's principle and apply it to several known examples of physical systems, especially the problem of static equilibrium. Derive the Euler-Lagrange equations from D'Alambert's principle.

2. Formulate the variational principle and apply it to the example of the brachistochrone, derive the Euler-Lagrange equations and apply them in describing physical systems with or without constraints.

3. Explain Hamilton's formulation of classical mechanics and the concept of phase space. Describe Legendre transformations in the context of mechanics. State and prove Liouville's theorem. Separate the Hamilton-Jacobi equation in Cartesian, cylindrical, and spherical coordinate systems.

4. Define Poisson brackets and prove their properties, define and apply canonical transformations, and explain the connection between the formalism of Poisson brackets and quantum mechanics.

5. Derive and solve the equations of motion for small oscillations. Find frequencies and normal coordinates theoretically and through examples.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. (3+2) Degrees of freedom, constraints on motion, and generalized coordinates.
2. (3+2) D'Alembert's principle and static equilibrium.
3. (3+2) Lagrangian formulation of classical mechanics, equivalence of Lagrangian and Newtonian mechanics.
4. (3+2) Hamiltonian formulation of classical mechanics.
5. (3+2) Phase space and canonical transformations.
6. (3+2) Hamilton-Jacobi formulation of classical mechanics, separation of variables in Hamilton-Jacobi equation.
7. (3+2) Liouville's theorem.
8. (3+2) Poisson brackets, invariance of Poisson brackets under canonical transformations.
9. (3+2) Infinitesimal canonical transformations, Noether's theorem.
10. (3+2) Connection between Poisson brackets and quantum mechanics.
11. (3+2) Canonical perturbation theory and its application to systems with one or more degrees of freedom.
12. (3+2) Small oscillations 1/2
13. (3+2) Small oscillations 2/2
14. (3+2) Introduction to classical field theory 1/2
15. (3+2) Introduction to classical field theory 2/2</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3"></td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table><tr><td>Class attendance</td><td>2.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr><tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr></table></td></tr>
</table>

	Essay		Seminar paper			
	Colloquiums		Oral exam	1.75		
	Written exam	1.75	Project			
Assessment and evaluation of student work	Twice during the semester, students take a written exam covering two halves of the material. Students who score more than 50% on each exam are exempt from taking the written exam and can proceed to the oral exam. Students who score 50% or more on the first written quiz can take the oral exam in two parts, immediately after the written exam is graded. The final grade is based on the written exam (worth 1/2 of the grade) and the performance on the oral exam (worth 1/2 of the grade).					
Required literature	Title	Number of copies available	Availability on other medium			
	Herbert Goldstein, John Safko, Charles Poole: Classical Mechanics, Pearson New International Edition, Pearson; 3rd edition (July 25, 2013)	3	no			
	David Morin: Introduction to Classical Mechanics: With Problems and Solutions, Cambridge University Press; 1st edition (February 4, 2008)	4	no			
Supplementary literature	Slides and lecture notes.					
Quality assurance	1. Teachers who have correlated learning outcomes collaborate and jointly ensure the quality of teaching. 2. Statistical analysis of exam results and evaluation of success in accordance with the stated learning outcomes. 3. Student evaluation through an anonymous survey conducted in accordance with the regulations of the University of Split.					
Other (in the opinion of the proponent)						

Subject name	Classical Electromagnetism					
ID	PMP112	Study year	3.			
Lecturer	izv. prof. dr. sc. Petar Stipanović	Points value (ECTS)	6.0			
Associates		Class execution (number of hours in semester)	L	S	E	P
			45	15	30	0
Subject status	Compulsory	Online percentage	10%			
Subject description						
Subject goals	Formulation of basic laws of classical electromagnetic theory with the development of mathematical methods for solving static problems and critical judgments of their applicability to classical physical problems.					
Enrolment requirements	Prior knowledge of mathematical analysis (differential and integral calculus with functions of several variables) and differential equations is required. – Mathematical Methods of Physics I (passed) – Differential Equations (attended) – Electricity and Magnetism (passed) – Waves and Optics (attended)					
Learning outcomes	1. Define the basic quantities and concepts of electromagnetism (electric/magnetic field, electric/magnetic potential, electric displacement, magnetic induction, field flux, polarization, susceptibility, dielectric, ferroelectric, paramagnet, diamagnet, ferromagnet) and discuss their meaning and characteristics. 2. Formulate the basic laws of electrostatics and magnetostatics in vacuum and matter (Gauss's law, Biot-Savart's law, Lorentz force, Maxwell's equations, continuity equation...) using vector analysis (vector differential operators, Gauss's and Stokes' theorem, ...) and evaluate their relevance. 3. Formulate basic quantities and laws of classical electrodynamics in vacuum and matter (Maxwell's equations in differential and integral form, mutual inductance, law of conservation of charge and energy, ...) using vector analysis and evaluate which are relevant to the given problem and describe the problem with differential/integral equations. 4. Analyze the contributions of free and bound sources of electromagnetic fields in electrically/magnetically polarized substances and determine the macroscopic effects of electrical/magnetic polarization. 5. For given constant charge/current distributions, estimate electromagnetic potentials and fields, argue their dis-/continuity at the edge and sketch the dependence of the observed quantities. 6. Expand the electric/magnetic potential in a multipole series and analyze and evaluate the contributions of the terms. 7. By superimposing known or easily determinable electromagnetic quantities, evaluate the electromagnetic interaction of distant complex systems. 8. Choose a suitable method (separation of variables in a Cartesian, spherical or cylindrical coordinate system, method of images, multipole development,...) to solve Poisson's or Laplace's equation for given or estimated boundary conditions (Dirichlet's, Neuman's or Robin's), i.e. predict electric/magnetic potential/field in a given system (e.g. charge above the ground plane, sphere of linear dielectric in a homogeneous field...). 9. Qualitatively and quantitatively compare the potentials, fields and energies for similar distributions of the corresponding sources, and based on analogies, predict the characteristics of other systems.					
Syllabus	Seminars and exercises following the lectures in units: **I. ELECTROSTATICS:** **(6h) Electrostatics of various charge distributions** (vector analysis, electric force, electric field, Maxwell 's equations for electrostatics, electrical potential, energy, conductors); **(9h) Special Techniques** (Poisson and Laplace equation and boundary conditions, methods of separating variables, method of images, multipole expansion, Green's functions); **(6h) Electrostatics in matter** (polarization, volume and surface bound charges, electrical displacement, energy, linear and nonlinear matter); **II. MAGNETOSTATICS:** **(9h) Magnetostatics of various current distributions** (magnetic force, magnetic field, Biot-Savart law, Maxwell 's equations for magnetostatics, magnetic vector					

<table>
<tr><td></td><td>potential, boundary conditions, multipole expansion);
(6h) Magnetostatics in matter (magnetization, volume and surface bound currents, magnetic field in matter, linear and nonlinear matter).

III. ELECTRODYNAMICS
(9h) Maxwell's formulation of classical electrodynamics (electromotive force, Faraday's law, electromagnetic induction, energy of the electromagnetic fields, Maxwell's equations and boundary conditions, conservation laws)</td></tr>
<tr><td>Teaching types</td><td><table>
<tr><td>☑ Lectures
☑ Seminars
☑ Exercises</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia</td><td>☐
☐</td></tr>
<tr><td>☐ Fully online
☐ Combined online</td><td>☐ Laboratory
☐ Mentoring</td><td>☐
☐</td></tr>
</table></td></tr>
<tr><td>Student obligations</td><td>1. Active participation on lectures by giving critical judgment and argumentation of opinions, asking and answering questions.
2. Solve given problems from electromagnetism.
3. Discuss given concepts and laws and their applicability.</td></tr>
<tr><td>Monitoring student work</td><td><table>
<tr><td>Class attendance</td><td>3</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1.5</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td>The final grade is formed after the student passes both test parts:
written exam (problem solving, 50% rating) and oral exam (theory, 50% rating).
During classes, short tests of learning outcomes are carried out, through which it is possible to be exempted from part of the exam, and colloquia (problems tasks) which are equivalent to the written exams.</td></tr>
<tr><td>Required literature</td><td><table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>David J. Griffiths: Introduction to Electrodynamics, Cambridge University Press, 2017.</td><td>13</td><td>yes</td></tr>
<tr><td>I. Supek: Teorijska fizika i struktura materije, Školska knjiga.</td><td>11</td><td>no</td></tr>
<tr><td>Lecture notes</td><td></td><td>yes</td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td>[1] John David Jackson: Classical electrodynamics, Wiley, New York.
[2] Different www-materials from electromagnetism</td></tr>
<tr><td>Quality assurance</td><td>1. Lecturers who teach subjects, which have correlated learning outcomes, collaborate and take care of teaching quality.
2. Statistics of exam results and evaluation of efficacy in accordance with the learning outcomes.
3. Student evaluation by anonymous survey conducted according to the rules of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td></td></tr>
</table>

Subject name	Climate System						
ID	PMP169	Study year	2.				
Lecturer	izv. prof. dr. sc. Jadranka Šepić	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			35	0	30	0	
Subject status	Compulsory	Online percentage	30%				

Subject description

Subject goals	Provide knowledge on: – components of natural and anthropogenic causes of climate change, – greenhouse gases and radiation processes, – observations of climate change parameters, – evaluation of climate models in historical periods, – modeling of climate parameters in future periods.
Enrolment requirements	– Meteorology I – Ocean Physics I – Introduction to Data Analysis – Meteorology II – Ocean Physics II
Learning outcomes	1. Understanding of climate and paleoclimatic dynamics. 2. Understanding the causes of climate change. 3. Understanding short-term and long-term climate fluctuations by weather and climate characteristics. 4. Knowledge of theoretical and practical applications of climate models. 5. Expertise in methods of mitigating the effects of climate change on human beings activities and environment.
Syllabus	1. Natural and anthropogenic causes of climate change (2h) 2. Basic concepts of paleoclimatology (2h) 3. Observations of climate change (2h) 4. Energy balance at the earth surface and atmosphere (3h) 5. Ocean influence on climate (2h) 6. Hydrological cycle (2h) 7. Greenhouse gases (2h) 8. Aerosols and radiation processes (2h) 9. Short-term climate variabilities (El Nino, La Nina, Pacific decadal oscillation, North Atlantic oscillation, Madden-Julian oscillation) (4h) 10. Basic structure of climate models (3 hours of lectures) 11. Applications of global and regional climate models (3h) 12. Uncertanties and errors of climate models (2h) 13. Projections of future climate by climate models (3h) 14. Application of climate models to the local region (1h) 14. Mitigation of climate change effects (2h)
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring ☐ ☐ ☐ ☐
Student obligations	Attend at least 70% of lectures and 70% of exercises.

Monitoring student work						
	Class attendance	2	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	1		
	Colloquiums		Oral exam	2		
	Written exam		Project	1		

Assessment and evaluation of student work	The grade is determined on the basis of: – oral presentations, – domestic works.

Required literature		Number of	Availability on

	Title	copies available	other medium
	J. David Neelin, Climate Change and Climate Modelling, Cambridge University Press, 2011		yes
	Egbert Boeker & Rienk van Grondalle, Environmental Physics: Sustainable energy and climate change, Wiley, 201		yes
Supplementary literature	[1] Intergovernmental Panel on Climate Change, Third Assessment Report of the International Panel on Climate Change. Volumes, Cambridge University Press, 2001.		
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Kognitivna psihologija</td></tr>
<tr><td>ID</td><td>PMS174</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Nikola Marangunić</td><td>Points value (ECTS)</td><td>4.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 15, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Razumijevanje temeljnih pojmova psihologije učenja, pamćenja, percepcije i inteligencije. Upoznavanje teorijske i praktične osnove zakonitosti stjecanja znanja i rješavanja problema.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Nema ih.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Nakon odslušanog i položenog predmeta studenti će moći:
1. Opisati temeljne postavke kognitivne psihologije.
2. Definirati kognitivnu neuroznanost kao osnovu znanstvenog proučavanja ljudske spoznaje.
3. Opisati temeljne spoznajne procese poput pažnje, percepcije, pamćenja i učenja.
4. Navesti različite reprezentacije znanja.
5. Interpretirati načine rješavanja problema kod kreativnih i nadarenih učenika.
6. Opisati faze kognitivnog razvoja.
7. Interpretirati razlike ljudske i umjetne inteligencije.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Uvod u kolegij; 2. Uvod u područje kognitivne psihologije; 3. Kognitivna neuroznanost; 4. Pažnja i svijest; 5. Percepcija; 6. Procesi pamćenja; 7. Reprezentacija znanja: predodžbe i propozicije; 8. Reprezentacija i organizacija znanja; 9. Jezik: priroda i usvajanje; 10. Rješavanje problema; 11. Kreativnost; 12. Nadarenost; 13. Odlučivanje i rezoniranje; 14. Kognitivni razvoj; 15. Ljudska i umjetna inteligencija.</td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3"></td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance; Research; Practical work
Experimental work; Paper
Essay; Seminar paper
Colloquiums; Oral exam
Written exam; Project</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Nazočnost na nastavi, aktivnost na nastavi, izrada samostalnih zadataka, rad na projektu, završni projekt.</td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
–</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">1. Zarevski, P. (2007). Psihologija pamćenja i učenja. Naklada Slap, Jastrebarsko.
2. Howe, M. J. A. (2002). Psihologija učenja. Naklada Slap, Jastrebarsko.
3. Rathus, S. A. (2001). Temelji psihologije. Naklada Slap, Jastrebarsko</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Combinatorics						
ID	PMM804	Study year	2.				
Lecturer	doc. dr. sc. Snježana Braić	Points value (ECTS)	5.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	30	0	
Subject status	Compulsory	Online percentage	30%				

Subject description

Subject goals	The aim of the course is to introduce students to the basic topics of combinatorics and discrete mathematics. Students will: learn how to count some different types of discrete structures using counting techniques; adopt basic properties of some discrete structures, and learn how to relate these to practical examples.
Enrolment requirements	Prerequisites: Taken courses Differential and integral calculus I and Linear algebra Entry competences: Students should be familiar with using the concepts of elementary mathematics, differential and integral calculus and vector spaces.
Learning outcomes	Students will be able to : • formulate theorems and definitions of important concepts in discrete mathematics, and illustrate them with discrete mathematics examples. • construct mathematical proofs, • solve problems using counting techniques, recurrence relations and generating functions, • apply the obtained knowledge and skills to investigate and solve a variety of discrete problems.
Syllabus	Introduction to combinatorics. Counting techniques, Dirichlet's principle, Ramsey numbers. (5) Permutations and combinations of sets and multisets. Binomial and multinomial coefficients. Inclusion-exclusion. (11) Recurrence relations, generating functions. Solving recurrences using generating functions. (10) Some highlighted topics in discrete mathematics. (4)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Class attendance. Students are expected to be present at least 70% of classes.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam	1.5		
Written exam	1.5	Project			

Assessment and evaluation of student work	Two partial written exams / one final written exam and final oral exam. There are 2 partial written exams during the semester. Passing the both partial exams or the final written exam allows students to take the oral exam. Successfully passing the oral exam leads to a successful completion of the course.

Required literature

Title	Number of copies available	Availability on other medium
D. Veljan, Kombinatorna i diskretna matematika, Algoritam, Zagreb, 2001		
D. Veljan, Kombinatorika s teorijom grafova, Školska knjiga, Zagreb, 1989.		
M. Cvitković, Kombinatorika, zbirka zadataka, Element, Zagreb, 1994		

Supplementary literature	J. Matoušek, J. Nešetril, Invitation to Discrete Mathematics, Oxford University Press,

	Oxford, 1998. Peter J. Cameron, Combinatorics: Topics, Techniques, Algorithms. Cambridge University Press, Cambridge. 1994. (2nd edition) 1996. Peter J. Cameron, Notes on Combinatorics, http://www.maths.qmul.ac.uk/~pjc/notes/comb.pdf
Quality assurance	Anonymous student evaluations according to the regulations of the University of Split and summarizing test results.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Complex analysis</td></tr>
<tr><td>ID</td><td>PMM116</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Jurica Perić</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Aim of the course aims is to introduce basic concepts and results from the theory of complex functions of a complex variable, with an emphasis on the theory of analytical functions. Students must develop the ability of understanding the results presented in the lectures as well as setting up and solving tasks and problems that may be found in connection with these results. Techniques to solve tasks students acquire on the exercises.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Taken course „Foundation of mathematical analysis“.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">The student is able to:
– analyze the topological properties of a set of complex numbers
– analyze the importance of the Cauchy-Riemann conditions
– distinguish differentiable complex functions and functions of real variables
– connect differentiability with integral along closed curve (general Cauchy theorem)
– relate analyticity and development in order (Taylor and Laurent Development)
– classify singularities (pole, removable and essential singularity)
– apply the acquired knowledge on residuums in the calculation of special improper integrals</td></tr>
<tr><td>Syllabus</td><td colspan="3">Complex numbers C - 2 hours
Convergence of the series, closer of the set - 2 hours
Complex functions of complex variables, continuity, limit - 2 hours
Completeness - 2 hours
Compactness - 2 hours
Analytic functions, Cauchy-Riemann theorem - 2 hours
Integral of the complex function - 2 hours
General Cauchy theorem - 2 hours
Cauchy's integral formula - 2 hours
Series of functions - 2 hours
Uniformly convergent series of functions - 2 hours
Taylor and Laurent theorem - 2 hours
Isolated singularities - 3 hours
Residuum theorem and applications - 3 hours</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attendance at 70% of lectures.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper:
Colloquiums: 1; Oral exam: 3
Written exam: 1; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The exam is taken in written and oral form. Written exam is preliminary part of the exam and requirement for the oral exam is to pass a written exam. The written form of the exam can be taken partially, during class, where curriculum provided. Activity in class, solving homework, colloquium, written and oral examination are the elements from which form the final grade is formed.</td></tr>
<tr><td>Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
</table>

	B. Červar, Kompleksna analiza, skripta		
	Š. Ungar, Matematička analiza 4, (skripta), Zagreb, 2001.		
	H. Kraljević, S. Kurepa, Matematička analiza 4/I: Funkcije kompleksne varijable, Tehnička knjiga, Zagreb, 1986.		
Supplementary literature	S. Kurepa, Matematička analiza III, Tehnička knjiga, Zagreb, 1975. W. Rudin, Real and complex analysis, McGraw-Hill, New York, 1970.		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Communication Skills		
ID	PMSN09	Study year	2.
Lecturer	Ana Mršić Zdilar, pred.	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 15, S: 15, E: 0, P: 0
Subject status	Elective	Online percentage	0%

Subject description	
Subject goals	• to understand the basic concepts related to verbal and nonverbal communication, as well as the factors that influence these concepts; • to develop the skills of presentation planning, presentation structure, and presentation performance in the Croatian language; • to develop pragmatic language competence; • to adopt the basic principles of written communication.
Enrolment requirements	None.
Learning outcomes	tudents will be able to: 1. describe the theories and models of communication; 2. employ active listening techniques; 3. demonstrate questioning skills; 4. give a technical presentation; 5. critically evaluate their own communication skills; 6. recognize disfluent speech; 7. negotiate and demonstrate the skills of assertive communication
Syllabus	Definitions of communication; Overview of the theory of communication; Cross-cultural communication Verbal and nonverbal communication Questioning as a communication skill Active listening and Barriers to active listening Written communication; Project reports Presentation skills (systematic guide) Technical presentation Technical presentation and peer evaluation Assertive communication and Critical thinking Public speaking skills Types of speech disfluencies Group and Team communication
Teaching types	[x] Lectures [x] Seminars [ ] Exercises [ ] Fully online [ ] Combined online [ ] Fieldwork [ ] Individual assignments [ ] Multimedia [ ] Laboratory [ ] Mentoring [ ] [ ] [ ] [ ]
Student obligations	Active participation in all activities: lectures, consultations, searching the literature, individual work.

Monitoring student work

Class attendance	0.5	Research		Practical work	
Experimental work		Paper	1		
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam	0.5	Project			

Assessment and evaluation of student work	The final grade is determined as the average of: • assessment of oral presentation and peer assessment of oral presentation; • assessment of written communication skills, • written and oral assessment.

Required literature

Title	Number of copies available	Availability on other medium
-		

Supplementary literature

1.Davies, J. W.: Communication skills: A Guide for Engineering and Applied Science Students. Pearson: Prentice Hall, 2001.
2.Harris, T. E., Sherblom, J.C.: Small Group and Team Communication. Pearson

	Education/Allyn & Bacon, 2010.
Quality assurance	• Vođenje evidencije o prisutnosti na nastavi • Godišnja analiza uspješnosti polaganja ispita • Studentska anketa s ciljem evaluacije nastavnika • Samoevaluacija nastavnika • Povratna informacija od strane studenata koji su već diplomirali o relevantnosti sadržaja predmeta
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Conservation biology</td></tr>
<tr><td>ID</td><td>PMB525</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Sanja Puljas</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The rapid growth of the human population puts strong pressure on the survival of populations, communities and ecosystems on Earth. The aim of the course is to get acquainted with the scale of risk, understand the importance of conserving biodiversity and learn about ways in which knowledge of ecology can help increase the likelihood of maintaining biodiversity in the future.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">There are no entry competences.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Student will be able to:
-define conservation biology as an interdisciplinary science,
-define basic concepts about the goals of conservation biology,
-explain what biodiversity is and how it is measured,
-understand the value of biodiversity,
-enumerate the factors that lead to biodiversity endangerment,
-explain the negative impact on human biodiversity systems,
-connect the causes of biodiversity loss with their consequences,
-understand the importance of conserving endemics and species threatened by global extinction,
-critically discuss the reflection and planning of scientific research in the field of conservation biology,
-critically discuss management plans and strategies in conservation biology.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Student will be able to:
-define conservation biology as an interdisciplinary science,
-define basic concepts about the goals of conservation biology,
-explain what biodiversity is and how it is measured,
-understand the value of biodiversity,
-enumerate the factors that lead to biodiversity endangerment,
-explain the negative impact on human biodiversity systems,
-connect the causes of biodiversity loss with their consequences,
-understand the importance of conserving endemics and species threatened by global extinction,
-critically discuss the reflection and planning of scientific research in the field of conservation biology,
-critically discuss management plans and strategies in conservation biology.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☑ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Students' presence in the amount of at least 70% of scheduled lectures, student seminar work.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper: 1
Colloquiums: ; Oral exam:
Written exam: 1; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Students' presence in the amount of at least 70% of scheduled lectures, student seminar work.</td></tr>
<tr><td>Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
</table>

	Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu (2021). Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwell.		
	Sodhi, N.S., Ehrlich P.R. (2010): Conservation Biology for All. Oxford University Press. (pdf)		
	Šolić, Mladen (2009) Ljepota različitosti : Ekološki uzroci biološke raznolikosti na zemlji, Zagreb : Izvori, 286 str.		
	Maguire, I., Lazar, B. (2014): Konzervacijska biologija.		
Supplementary literature	- Primack RB (2010): Essentials of Conservation Biology, 5th ed. Sinauer Associates, 601 str. -Relevant scientific articles.		
Quality assurance	-Taking attendance of students during classes. -Students' survey evaluation of teacher's work. -Feedback from graduated students on the relevance of the course content.		
Other (in the opinion of the proponent)	Consultations are taking place according to the agreement with the students or by e-mail: spuljas@pmfst.hr		

<table>
<tr><td>Subject name</td><td colspan="3">Konzervacijska biologija</td></tr>
<tr><td>ID</td><td>PMB525</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Sanja Puljas</td><td>Points value (ECTS)</td><td>4.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Brzi rast ljudske populacije vrši snažan pritisak na opstanak populacija, zajednica i ekosustava na Zemlji. Cilj predmeta je upoznavanje s razmjerima rizika, razumijevanje važnosti očuvanja biološke raznolikosti te upoznavanje s načinima na koje poznavanje ekologije može pomoći u povećanju vjerojatnosti održanja biološke raznolikosti u budućnosti.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Usvojena temeljna znanja iz biologije i ekologije.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Nakon uspješno završenog predmeta student će moći:
Definirati konzervacijsku biologiju kao interdisciplinarnu znanost.
Definirati osnovne pojmove o ciljevima konzervacijske biologije.
Objasniti što je biološka raznolikost i kako se mjeri.
Razumjeti vrijednost biološke raznolikosti.
Nabrojiti čimbenike koji dovode do ugrožavanja bioraznolikosti.
Objasniti negativan utjecaj čovjeka na bioraznolikost ekoloških sustava.
Povezati uzroke gubitka biološko raznolikosti s njihovim posljedicama.
Razumjeti važnost očuvanje endema i vrsta kojima prijeti globalno izumiranje.
Kritički raspraviti o promišljanju i planiranju znanstvenih istraživanja iz područja konzervacijske biologije.
Kritički raspraviti o planovima upravljanja i strategijama u konzervacijskoj biologiji.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Predavanja:
Uvod u konzervacijsku biologiju.
Bioraznolikost – koncept vrsta u konzervacijskoj biologiji.
Konzervacijska genetika – genetska raznolikost: bottleneck efekt, founder efekt, genetski drift, inbreeding, outbreeding, genetika i očuvanje vrsta.
Kvantificiranje bioraznolikosti – indeks bogatstva vrsta (Species richness), Shannonov indeks H, ravnomjernost (Evenness), brojnost pojedine vrste (Abundance).
Analiza vijabilnosti populacija (PVA analize).
Bioraznolikost i prostorna skala – rizik od izumiranja na različitim prostornim skalama: lokalnoj, regionalnoj i globalnoj,
Fragmentacija, destrukcija i degradacija staništa.
Promjene bioraznolikosti pod utjecajem čovjeka.
Bioraznolikost i klimatske promjene.
Endemi i očuvanje vrsta kojima prijeti globalno izumiranje.
Unešene i invazivne vrste i njihov utjecaj na bioraznolikost.
Konzervacijska etika: Callicot (1990) – 3 etička principa: Romantično-transcendentalna etika (John Muir 1838-1914) , Etika konzervacije resursa (Pinchot, 1865-1946), Evolucijsko-ekološka etika -(Aldo Leopold, 1886-1948).
Zakonske osnove konzervacijske biologije, utjecaj ekonomskih i političkih čimbenika na konzervacijsku biologiju, planovi upravljanja i strategije u konzervacijskoj biologiji.
Planiranje znanstvenih istraživanja iz područja konzervacijske biologije.
Restoracijska ekologija s primjerima.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☑ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Pohađanje nastave u iznosu od najmanje 70% predviđene satnice te izrada seminarskog rada.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums		Oral exam	0.5		

</td></tr>
</table>

	Written exam	0.5	Project			
Assessment and evaluation of student work	Studenti se ocjenjuju temeljem seminarskog rada, pismenog i usmenog ispita.					
Required literature	Title	Number of copies available	Availability on other medium			
	Sodhi, N.S., Ehrlich P.R. (2010): Conservation Biology for All. Oxford University Press. (pdf)					
	Šolić, Mladen (2009) Ljepota različitosti : Ekološki uzroci biološke raznolikosti na zemlji, Zagreb : Izvori, 286 str					
	Maguire, I., Lazar, B. (2014): Konzervacijska biologija.					
Supplementary literature	– Groom MJ, Meffe GK and Carroll CR (2005) Principles of Conservation Biology, 3rd ed. Sinauer Associates, 699 str. – Primack RB (2010): Essentials of Conservation Biology, 5th ed. Sinauer Associates, 601 str. – Relevantni znanstveni članci.					
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split					
Other (in the opinion of the proponent)						

<table>
<tr><td>Subject name</td><td colspan="3">Vertebrates</td></tr>
<tr><td>ID</td><td>PMB517</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Antonela Paladin</td><td>Points value (ECTS)</td><td>6.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30 | S: 15 | E: 30 | P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3"></td></tr>
<tr><td>Enrolment requirements</td><td colspan="3"></td></tr>
<tr><td>Learning outcomes</td><td colspan="3"></td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3"></td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance ☐ | Research ☐ | Practical work ☐
Experimental work ☐ | Paper ☐
Essay ☐ | Seminar paper ☐
Colloquiums ☐ | Oral exam ☐
Written exam ☐ | Project ☐</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3"></td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
–</td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="6">Kralježnjaci</td></tr>
<tr><td>ID</td><td>PMB031</td><td>Study year</td><td colspan="4">3.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Antonela Paladin</td><td>Points value (ECTS)</td><td colspan="4">6.5</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>15</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">10%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Stečena znanja omogućuju studentima usvajanje i razumijevanje evolucijskog razvoja, anatomije, taksonomije i rasprostranjenosti svitkovaca (kralježnjaka). Poseban naglasak dat je na razumijevanje komparativne anatomije između različitih razreda kralježnjaka.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Potrebne kompetencije studenata za predmet Kralježnjaci su predznanja iz predmeta Opća zoologija i Beskralježnjaci.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Student će nakon položenog ispita moći:
1.Analizirati glavne anatomske osobine svitkovaca, s naglaskom na kralježnjake
2.Definirati sistematsku podjelu svitkovaca na temelju morfologije, anatomije, fiziologije i ekologije
3.Objasniti razvoj organskih sustava kralježnjaka tijekom evolucije
4.Integrirati anatomska svojstva pojedinih skupina kralježnjaka
5.Argumenirati principe fizioloških procesa u organskim sustavima kralježnjaka
6.Usvojiti temeljna znanja evolucije, paleontologije i zoogeografije kralježnjaka
7.Definirati glavna staništa kralježnjaka u Republici Hrvatskoj</td></tr>
<tr><td>Syllabus</td><td colspan="6">Predavanja:
1. Uvod u kralježnjake, sistematska podjela koljena Chordonia, osobine svitkovaca. (2 sata)
2. Hemichordata (polusvitkovci) - glavne anatomske osobine, fiziologija i sistematika. (2 sata)
3. Tunicata (plaštenjaci) - sistematika, anatomija i fiziologija glavnih mješčićnica, repnjaka, salpi i bačvica. (2 sata)
4. Cephalochordata (svitkoglavci) - glavne anatomske i fiziološke osobine kopljače. (2 sata)
5. Anatomsko - fiziološke osobine potkoljena Vertebrata (pravi kralježnjaci). Glavne osobine Cyclostomata (kružnouste). (2 sata)
6. Chondrichthyes (hrskavične ribe) – vanjska morfologija, građa kože, kostur, mišići, disanje, krvotok. (2 sata)
7. Chondrichthyes (hrskavične ribe) - osmoregulacija, živčani sustav, osjetila, mokraćno-spolni sustav i razmnožavanje, evolucija, sistematska podjela. (2 sata)
8. Osteichthyes (koštunjače) - vanjska morfologija i struktura koža, kostur, mišići, probava, endokrini sustav, disanje, krvotok, živčani sustav. (2 sata)
9. Osteichthyes (koštunjače) - osjetila, mokraćno-spolni sustav i razmnožavanje, značajni organi riba, evolucija riba, sistematska podjela koštunjača. (2 sata)
10. Amphibia (vodozemci) - anatomsko-fiziološke osobine (2 sata)
11. Reptilia (gmazovi) - anatomsko-fiziološke osobine (2 sata)
12. Aves (ptice) - vanjska obilježja i građa kože, kostur, mišići, razvoj i struktura pera, probava, disanje i zračne vrećice. (2 sata)
13. Aves (ptice) - endokrini sustav, krvotok, živčani sustav, mokraćno-spolni sustav, razmnožavanje, fiziologija leta, sistematika ptica. (2 sata)
14. Mammalia (sisavci) - vanjska morfologija, kostur, mišići, probava, krvotok, živčani sustav i osjetila. (2 sata)
15. Mammalia (sisavci), mokraćno-spolni sustav, razvoj embrija i mladih, evolucija i sistematika sisavaca. Zoogeografija sisavaca. Poredbena anatomija pravih kralježnjaka (2 sata).
Seminar i vježbe
1. Polusvitkovci (Hemichordata) i Plaštenjaci (Tunicata) - stanište, ekologija, osnovni princip građe tijela, sistematika, pregled najznačajnijih vrsta i njihove glavne osobine (1 + 2 sata)
2. Svitkoglavci (Cephalochordata) - stanište, ekologija, osnovni princip građe tijela, sistematika, pregled najznačajnijih vrsta (1 + 2 sata)
3. Kružnouste (Cyclostomata) - stanište, ekologija, osnovni princip građe tijela, sistematika, pregled najznačajnijih vrsta (1 + 2 sata)
4. Hrskavičnjače (Chondrichthyes) - ekologija, osnovni princip vanjske građe tijela (1 + 2 sata)</td></tr>
</table>

	5. Hrskavičnjače (Chondrichthyes) – fiziologija, osmoregulacija, osnovni princip unutarnje građe tijela, sistematika, pregled najznačajnijih vrsta i njihove glavne osobine (1 + 2 sata) 6. Koštunjače (Osteichthyes) – ekologija, osnovni princip građe tijela, sistematika, pregled najznačajnijih vrsta (1 + 2 sata) 7. Determinacija jadranskih vrsta riba, korištenje ključa za determinaciju (1 + 2 sata) 8. Vodozemci (Amphibia) – staništa, ekologija, osnovni princip građe tijela, sistematika, pregled najznačajnijih vrsta (1 + 2 sata) 9. Gmazovi (Reptillia) – staništa, ekologija, osnovni princip građe tijela, sistematika, pregled najznačajnijih vrsta (1 + 2 sata) 10. Vodozemci i gmazovi Hrvatske (1 + 2 sata) 11. Ptice (Aves) – obitavališta, ekologija, osnovni princip vanjske građe tijela (1 + 2 sata) 12. Ptice (Aves) – osnovni princip građe tijela, sistematika, pregled najznačajnijih vrsta (1 + 2 sata) 13. Ptice Hrvatske (1 + 2 sata) 14. Sisavci (Mammalia) – staništa, osnovni princip građe tijela, sistematika, pregled najznačajnijih vrsta i njihove glavne osobine (1 + 2 sata) 15. Sisavci Hrvatske, staništa sisavaca u RH (1+ 2 sata)

Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐

Student obligations	Obvezno pohađanje predavanja i praktikuma iz Vertebrata

Monitoring student work	Class attendance	1	Research		Practical work	1.5
	Experimental work		Paper			
	Essay		Seminar paper	2		
	Colloquiums		Oral exam	1		
	Written exam	1	Project			

Assessment and evaluation of student work	Tijekom semestra obvezna su dva kolokvija koja uključuju odslušani dio predavanja i odrađeni dio vježbi iz praktikuma. Završni ispit sastoji se od obveznog pismenog i usmenog dijela ispita.

Required literature	Title	Number of copies available	Availability on other medium
	Young J.Z. : The life of Vertebrates. Clarendon press – Oxford, 1989.		
	F.H. Pough, C.M, Janis. J.B, Heiser: Vertebrate life. Ninth edition. Pearson Prentice Hall, 2005		
	Kardong KV, Zalisko E: Comparative Vertebrate Anatomy, A Laboratory dissection Guide, McGraw-Hill Education; 2014		

Supplementary literature	Jardas I: Jadranska ihtiofauna. Školska knjiga, Zagreb, 1997. Svensson L. Mullarney K, Zetterström D: Ptice Hrvatske i Europe, Udruga Biom Zagreb, 2018. Šafarek G. Životinje Hrvatske. Mozaik knjiga d.o.o. Zagreb, 2014.
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Cryptography</td></tr>
<tr><td>ID</td><td>PMM205</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Borka Jadrijević</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 15, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>40%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The objective of this course is to introduce students to the basic ideas, techniques and algorithms used in cryptography and its applications. The course is a good background for understanding and learning more advanced courses in this area.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Completed course: Introduction to number theory</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon successful completion of the course, the student is able to:
-decrypt messages encrypted using the different types of substitution ciphers and columnar transposition;
-describe the basic steps in modern block cryptosystems DES and AES;
-describe ideas of public-key cryptography and digital signature;
-define RSA cryptosystem and its connection with factorization of large integers;
-encrypt messages using public-key cryptosystems (RSA, Rabin, ElGamal, Merkle-Hellman);
-cryptoanalyze RSA cryptosystem with small public or secret exponent;
-define elliptic curve and describe the use of elliptic curves in cryptography;
-define notions of (Euler, strong) pseudoprime numbers and determine whether an integer is a pseudoprime;
-describe the most famous algorithms for primality testing and integral factorization.</td></tr>
<tr><td>Syllabus</td><td colspan="3">- Traditional ciphers.Basic notions. Caesar, Vigenère, Playfair and Hill's cipher. Statistical methods for cryptanalysis. Encryption devices. (7 hours)

- Modern Block Ciphers. Data Encryption Standard (DES). Cryptanalysis of DES. Advanced Encryption Standard (AES). (6 hours)

- Public-Key Cryptography.Concept of public-keycryptography. Digital signature. RSA cryptosystem. Other public-key cryptosystems. Cryptanalysis of public-key cryptosystem. Elliptic curves in cryptography. (9 hours)

- Primality Testing and Integral factorization. Pseudoprime numbers. Soloway-Strassen and Miller-Rabin primality test. Factor base. Continued fraction factorization method. Quadratic sieve factoring algorithm. (8 hours)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attendance of lectures and tutorial sessions is obligatory. Students should present a seminar and solve the homework assignments.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1 | Research: | Practical work:
Experimental work: | Paper: | Domaće zadaće: 1.5
Essay: | Seminar paper: 1 |
Colloquiums: | Oral exam: 1.5 |
Written exam: | Project: | </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Successful seminar and success in solving homework assignments are prerequisites for the oral exam. All parts of the exam are equally weighted in the final grade.</td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
A.Dujella, M. Maretić: Kriptogrfija, Element, Zagreb, 2007.; | 3 |
D. R. Stinson: Cryptography. Theory and Practice, CRC | | </td></tr>
</table>

	Press, Boca Raton, 2002.	1	
	N. Koblitz: A Course in Number Theory and Cryptography, Springer-Verlag, New York, 1994.	2	
Supplementary literature	N. Smart: Cryptography. An Introduction, McGraw-Hill, New York, 2002;		
Quality assurance	Statistics of test results and anonymous student evaluations at the end of the semester according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="6">Quantum Physics</td></tr>
<tr><td>ID</td><td>PMP117</td><td>Study year</td><td colspan="4">3.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Leandra Vranješ Markić</td><td>Points value (ECTS)</td><td colspan="4">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>40</td><td>15</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">10%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">To teach students basic concepts in quantum mechanics and their application to simple problems and hydrogen atom.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Learning outcomes in general physics, classical mechanics, linear algebra and differential equations.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. Explain and apply concepts and principles of quantum mechanics (Schrödinger equation, wave function, probability amplitude, state space, physical observables and operators, wave equation, superposition and complementarity, time evolution, expectation values, matrix representation) and connect them to experimental realisations.
2.Discuss and apply the Heisenberg uncertainty relations, determine commutators for different pairs of operators and discuss the consequence of uncertainty relations on measurement of corresponding physical properties.
3. Discuss and solve time-independent Schrödinger equation for bound and scattering states for important one dimensional systems (e.g. square well, harmonic oscillator, potential barrier), interpret obtained wave functions and calculate the expectation values of particular quantities (position, momentum, energy), probabilities and time evolution of solutions, as well as the coefficients of reflection and transmission.
4.Discuss the concept of angular momentum in quantum mechanics, its connection with rotation operator and determine its eigenvalues and eigenfuctions.
5. Discuss and solve time-independent Schrödinger equation for bound and scattering states for important potentials (free particle, particle in a box, harmonic oscillator), interpret obtained wave functions and calculate the expectation values of particular quantities (position, momentum, energy), probabilities and time evolution of solutions
6. Discuss ad solve quantum description of hydrogen atom, determine eigenfunctions and eigenvalues and connection to experiments.
7. Discuss the concept of spin, calculate eignefunctions and eigenvalues of spin operator.</td></tr>
<tr><td>Syllabus</td><td colspan="6">1. Wave-particle duality. Stern-Gerlach experiment. Analogy with polarisation of light. (5h)
2. Mathematical tools of quantum mechanics; Hilbert spaces, wave functions and Dirac notation (5h)
3. Operators. Uncertainty relations. (5h)
4. Representation in discrete and continuous bases. (5h)
5. Postulates of quantum mechanics. (5h)
6. Measurement and observables. (5h)
7. Time evolution. Schrodinger equation. Stationary states. Time evolution of expectation values. Wave packets. (8h)
8. Symmetries and conservation laws. (2h)
9. The Ehrenfest theorem. Connecting quantum to classical mechanics. (3h)
10. General properties of Schrodinger equation in 1D. The infinite square well potential. (4h)
11. One dimensional problems with potential barriers. (6h)
12. Harmonic oscillator. (6h)
13. General formalism of angular momentum and matrix representation. Eingenstates of orbital angular momentum. (8h)
14. Problems in three dimensions. Hydrogen atom. (10h)
15. Spin. Application (8h).</td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☑ Exercises
☐ Fully online</td><td colspan="2">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory</td><td colspan="3">☐
☐
☐</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">☑ Combined online</td><td colspan="4">☐ Mentoring</td><td>☐</td></tr>
<tr><td>Student obligations</td><td colspan="7">Active participation during class attendance.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>3</td><td>Research</td><td></td><td>Practical work</td><td></td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Samostalni rad i ispit</td><td>3</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="7">Colloquia and final exam.</td></tr>
<tr><td rowspan="5">Required literature</td><td colspan="5">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="5">N. Zettili, „Quantum Mechanics: Concepts and applications“</td><td>4</td><td></td></tr>
<tr><td colspan="5">Web pages with solved examples</td><td></td><td>Moodle, Web page</td></tr>
<tr><td colspan="5">Popular articles</td><td></td><td>Moodle, Web page</td></tr>
<tr><td colspan="5">Presentations from lectures</td><td></td><td>Moodle, Web page</td></tr>
<tr><td>Supplementary literature</td><td colspan="7">1. R. Scherrer „Quantum mechanics: An Accessible Introduction“
2. R. L. Liboff, „Introductory Quantum Mechanics“
3. D. J. Griffits, “Introduction to QuantumMechanics”
4. Auletta, Genaro, Parisi, “QuantumMechanics”</td></tr>
<tr><td>Quality assurance</td><td colspan="7">– following the success of students in colloquia and exam
– following the student success in the following exams and the connection to the success of this course
– student surveys</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="7"></td></tr>
</table>

Subject name	Quantum Computing		
ID	PMP202	Study year	1.
Lecturer	prof. dr. sc. Leandra Vranješ Markić	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 15, P: 0
Subject status	Elective	Online percentage	10%

Subject description	
Subject goals	Introduce students to realisations of quantum computers, basics of quantum computing, important quantum algorithms and their application. Develop skills of the design of quantum programs and their execution of quantum computers and simulators.
Enrolment requirements	Competences from quantum physics course.
Learning outcomes	After successful completion of the course the students will be able to: 1) discuss advantages and disadvantages of quantum computing with respect to classical computing; 2) explain basics models of quantum computing and the structure of introduces quantum algorithms and protocols; 3) discuss basic hardware realisations of quantum computers; 4) solve quantum-computing reversible logic gates with single and multi qubit states; 5) program simple quantum algorithms on cloud quantum computer or simulator; 6) discuss and apply basic error correcting codes.
Syllabus	• Qubit representation. Elementary quantum gates and basic quantum computing formalism (8 hours) • Comparison between quantum and classical computing. Complexity classes (2 hours) • Elements of quantum programs. Introduction to libraries for quantum computing (4 hours) • Superdense quantum coding. Teleportation and Bells inequalities (4 hours) • Other models of quantum computing: measurement-based quantum computing and adiabatic quantum computing (2 hours) • Quantum algorithms. Deutsch-Jozsa's algorithm. (5 hours) • Bernstein-Vazirani's algorithm (3 hours) • Simon's algorithm. Grover's algorithm. (6 hours) • Quantum Fourier transform. Shor's algorithm. (6 hours) • Hybrid algorithms. Variational quantum eigensolver and applications. (6 hours) • Quantum error correction. (6 hours) • Hardware realisations of quantum computers. (4 hours) • Modern applications of quantum computers. (4 hours)
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☑ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Active participation in lectures, seminars and exercise classes.

Monitoring student work

Class attendance	2	Research		Practical work	4
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	Homework assignments, seminar, final exam

Required literature

Title	Number of copies available	Availability on other medium

	M. A. Nielsen and I. L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, Cambridge, 2010.		
	Ph. Kaye, R. Laflamme and M. Mosca, An Introduction to Quantum Computing, Oxford University Press, Oxford, 2007.		
Supplementary literature	Jack D. Hidary, Quantum Computing: An Applied Approach, Springer, 2nd edition, 2021 – uz popratne kodove na GitHub-u		
	Original papers and preprints.		
Quality assurance	Monitoring success in exams. Discussion with students and analysing their progress in solving problem and assignments. Student evaluation by anonymous survey conducted according to the rules of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Linear Algebra I</td></tr>
<tr><td>ID</td><td>PMM153</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Tea Martinić Bilać</td><td>Points value (ECTS)</td><td>8.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 45, S: 0, E: 60, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>15%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The aim of the course is to introduce students to the knowledge and skills in classical algebra of vectors and analytic geometry. Students will adopt an elementary knowledge in basic algebraic structures and vector spaces.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Prerequisites: none

Entry competences: Knowledge of secondary school mathematics</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Students will be able to:

– formulate the theorems and definitions of classic algebra of vectors, analytic geometry, and elementary algebraic structures,

– present in a clear manner correct mathematical reasoning and proofs,

– distinguish and give examples of elementary algebraic structures,

– demonstrate understanding of the concepts of vector space and subspace,

– solve problems within the course content.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Introduction – coordinate systems (2)
–Cartesian coordinate systems on the line, plane and in space.

Classical vector algebra. (11)
–Oriented lines and radius vectors. Basic operations with vectors and coordinatization. (4)
–Vectors. Collinearity and coplanarity. Basis and dimension. Coordinate space. (4)
–Inner product. Orthonormal basis. Inner product in coordinates. Outer product. Mixed product. (3)

Analytical geometry in E3. (13)
–Different plane equations. Point-plane distance, angle between two planes. (4)
–Line equations in space. Angle between lines and planes. Point-line distance. Common normal and distance between two lines. (3)
–Second order plane curves. Second order surfaces. (3)
–Polar, cylindrical and spherical systems. (3)

Algebraic structures. (9)
–Binary operations. Groupoid, semigroup, monoid, group – definitions, examples, basit properties. (3)
–Cyclic groups and permutation groups. (3)
–Group homomorphism – definition and examples. (1)
–Ring – definition and examples, basic properties. (1)
–Division ring and field. (1)

Linear spaces. (10)
–Definition and examples. (2)
–Linear (in)dependence. Basis and dimension. (4)
–Subspaces, intersection and sum. Quotient space. (4)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia</td><td>☐
☐</td></tr>
</table>

	Fully online Combined online		Laboratory Mentoring				
Student obligations	Class attendance. Students are expected to be present at least 70% of classes.						
Monitoring student work	Class attendance	3	Research		Practical work		
	Experimental work		Paper				
	Essay		Seminar paper				
	Colloquiums		Oral exam	3			
	Written exam	2.5	Project				
Assessment and evaluation of student work	There are 2 partial written exams during the semester and the final exam. Passing of either the partial exams or the written exam allows students to take the final (oral) exam. Successfully passing the oral exam leads to a successful completion of the course.						

Required literature	Title	Number of copies available	Availability on other medium
	K. Horvatić, Linearna algebra I i II, PMF – Matematički odjel, HMD, Zagreb, 1995.		
	N. Elezović, A. Aglić, Linearna algebra, Element, Zagreb, 1999.		
	N. Bakić, A. Milas, Zbirka zadataka iz linearne algebre s rješenjima, PMF-Matematički odjel, HMD, Zagreb, 1995.		
	N. Elezović, A. Aglić, Linearna algebra, Zbirka zadataka, Element, Zagreb, 1999.		

Supplementary literature	B. Pavković, D. Veljan, Elementarna matematika 2, Školska knjiga, Zagreb, 1994. S. Kurepa, Konačnodimenzionalni vektorski prostori i primjene, Liber, Zagreb 1992.
Quality assurance	Anonymous student evaluations according to the regulations of the University of Split and summarizing test results.
Other (in the opinion of the proponent)	

Subject name	Linear algebra II		
ID	PMM154	Study year	1.
Lecturer	prof. dr. sc. Borka Jadrijević	Points value (ECTS)	8.5
Associates		Class execution (number of hours in semester)	L: 45, S: 0, E: 60, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description

Subject goals	
Enrolment requirements	
Learning outcomes	
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	

Monitoring student work

Class attendance	2.5	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam	3		
Written exam	3	Project			

Assessment and evaluation of student work	

Required literature

Title	Number of copies available	Availability on other medium
K. Horvatić, Linearna algebra, Golden marketing, Tehnička knjiga, Zagreb, 2004. dovoljan da		DA

Supplementary literature	1. Damir Bakić, Linearna algebra, Školska knjiga, Zagreb, 2008. 2. S.H. Friedberg, A.J. Insel and L.E. Spence, Linear Algebra, Prentice Hall, 2003. 3. J. Hefferon, Linear Algebra, http://joshua.smcvt.edu/linearalgebra/
Quality assurance	
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Makrozoobentos krških tekućica</td></tr>
<tr><td>ID</td><td>PPB266</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Biljana Apostolska</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">upoznati ekologiju kopnenih voda – upoznati porijeklo krških tekućica – nabrojiti krške tekućice u Republici Hrvatskoj – abiotički i biotički parametri ovih vodotokova – makro avretebrati i njihova uloga u ovim rijekama – biološko određivanje kvalitete vode putem različitih indeksa – zaštitna regulativa</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">nema</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Student će nakon položenog ispita moći:
1.objasniti i povezati abiotičke i biotičke parametre s biotom u tekućicama
2.objasniti razlike u krškim tekućicama
3.objasniti kako se sezonski i longitudinalno mijenjaju abitoički i biotički parametri
4.nabrojiti i prepoznati osnovne skupine makroavertebrata i njihove prilagodbe na stanište
5.objasniti što su bioindikatori
6.naučiti kako odrediti biološku kvalitetu vode putem makrozoobentosa
7.upoznati se s problemima onečišćenja ovih staništa i zakonskom regulativom u zaštiti istih</td></tr>
<tr><td>Syllabus</td><td colspan="3">Predavanja i seminar
1.Rasprostranjenje voda na kopnu i osnovne značajke tekućica uopće (2P+2S)
Krške tekućice-porijeklo i rasprostranjenje(2P+2S)
2.Abiotički i biotički parametri (2P+2S)
3.Fauna(2P+2S)
4.Makrozoobentos(2P+2S)
5.Biološko određivanje kvalitete vode (2P+2S)
6.Zakonska regulativa (2P+2S)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">- prema pravilniku o studiranju</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">usmeni ispit i seminarska prezentacija</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Paul S. Giller and Björn Malmqvist (1999) The Biology of Streams and Rivers</td><td></td><td></td></tr>
<tr><td>Ivo Matoničkin, Zlatko Pavletić (1972) ŽIVOT NAŠIH RIJEKA: Biologija tekućih voda</td><td></td><td></td></tr>
<tr><td>Campaioli, S., Ghetti, P.F., Minelli, A., Ruffo, S. (1994): Manuale per il riconoscimento dei macroinvertebrati delle acque dolci Italiane. Von Trento. Vol. I</td><td></td><td></td></tr>
<tr><td>Campaioli, S., Ghetti, P.F., Minelli, A., Ruffo, S. (1999): Manuale per il riconoscimento dei macroinvertebrati delle acque dolci Italiane. Von Trento. Vol. II</td><td></td><td></td></tr>
</table></td></tr>
</table>

	Erben, R., Leiner, S. (1997): Vode tekućice i njihov živi svijet II. Hrvatska vodoprivreda.		
	Giller P. S., Malmquist, B. (1998): The biology of streams and rivers. Oxford University Press, Oxford.		
	Kerovec, M. (1986): Priručnik za upoznavanje beskralježnjaka naših potoka i rijeka. Sveučilišna naklada Liber, Zagreb.		
Supplementary literature	Štambuk – Giljanović, N. (2002): Vode Cetine i njezina porječja. Zavod za javno zdravstvo Splitsko – dalmatinske županije, Split. Tedeschi, S. (1997): Zaštita voda. Sveučilišna tiskara, Zagreb		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="6">Mathematical analysis in R^n I</td></tr>
<tr><td>ID</td><td>PMM157</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Nikola Koceić-Bilan</td><td>Points value (ECTS)</td><td colspan="4">7.5</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>45</td><td>0</td><td>45</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">20%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Cilj predmeta je da studenti:
-usvoje osnovna znanja o topološkoj, metričkoj i vektorskoj strukturi n□dimenzionalnog euklidskog prostora Rn
-upoznaju pojmove nutrine, zatvarača, povezanosti, putovima povezanosti, kompaktnosti u Rn
-nauče pojam neprekidnosti, uniformne neprekidnosti i limesa funkcija između općenitijih struktura (metričkih i topoloških prostora) s naglaskom i primjenama na preslikavanja euklidskih prostora i vektorske funkcije
-usvoje konvergenciju nizova točaka u općenitijim strukturama s naglaskom i primjenama na Rn
-upoznaju pojam (uniformne) konvergencije niza funkcija
-usvoje pojam diferencijabilnosti funkcija koje operiraju između euklidskih prostora
-nauče određivati diferencijal funkcije matričnim zapisom linearnog operatora
-uspostaviti vezu između diferencijabilnosti skalarnih funkcija i njezinih parcijalnih derivacija i derivacija duž vektora
-primjenjuju osnovne teoreme diferencijalnog računa funkcija
-usvoje pojam neprekidne diferencijabilnosti i karakterizacije toga pojma
-usvoje pojam diferencijala višeg reda vektorskih funkcija
-nauče promatrati diferencijale viših redova skalarnih funkcija kao n-arne forme s primjenom na Taylorovu formulu
-nauče ispitivati i određivati lokalne ekstreme skalarnih funkcija pomoću njezinih diferencijala i parcijalnih derivacija</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Odslušani i položeni kolegiji: Uvod u matematičku analizu, Diferencijalni i integralni račun I, Linearna algebra II</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Od studenata/ica se nakon položenog kolegija očekuje da budu sposobni:
-opisati topološku, metričku i vektorsku strukturu n-dimenzionalnog euklidskog prostora i objasniti pojmove gomilišta, nutrine, zatvarača skupa, povezanosti, povezanosti putovima i kompaktnosti
-razlikovati neprekidnost i uniformnu neprekidnost preslikavanja potprostora euklidskih prostora
-pronaći limese i gomilišta nizova u euklidskom prostoru
-karakterizirati temeljne pojmove matematičke analize pomoću nizovne konvergencije
-računati limese skalarnih i vektorskih funkcija
-razlikovati točkovnu i uniformnu konvergenciju niza funkcija
-ispitati diferencijabilnost i neprekidnu diferencijabilnost vektorskih funkcija od više varijabli
-odrediti diferencijale svih redova preslikavanja f:Rm->Rn matričnim zapisom linearnog operatora pomoću parcijalnih derivacija i derivacija duž vektora
-primijeniti teoreme diferencijalnog računa funkcija f:Rm->Rn
-odrediti lokalne ekstreme skalarnih funkcija</td></tr>
<tr><td>Syllabus</td><td colspan="6">-Različite norme i inducirane metrike na Rn
.(1 P) (1 V)
-Topološka struktura euklidskog n-dimenzionalnog prostora. Topološki prostor i potprostor.(1 P) (1 V)
Gomilište skupa. Nutrina i zatvarač. Povezanost. Kompaktnost. (3 P) (3 V)
-Neprekidnost funkcija između različitih euklidskih potprostora Rn
te između
općenitijih metričkih i topoloških struktura (2 P) (3 V)
-Vektorski prostor neprekidnih funkcija C(Rm,Rn
). (2 P) (2 V)
-Homeomorfizam. Povezanost putovima. (1 P) (2 V)
-Invarijante neprekidnih preslikavanja. Neprekidnost na povezanim i kompaktnim prostorima. Teorem o međuvrijednostima (1 P) (1 V)
-Uniformna neprekidnost. Lipshitzovo svojstvo. (3 P) (3 V)</td></tr>
</table>

<table>
<tr><td></td><td>–Prostor linearnih operatora (1 P) (1 V)
–Limes funkcija (3 P) (5 V)
–Konvergencija nizova u euklidskom, metričkom i topološkom prostoru (2 P) (4 V)
–Karakterizacija zatvorenosti i neprekidnosti u metričkim i euklidskim prostorima pomoću konvergencije. (1 P) (1 V)
–Gomilišta i podnizovi nizova u euklidskom prostoru. Bolzano–Weirstrassov teorem (1 P) (2 V)
–Točkovna i uniformna konvergencija nizova funkcija (1 P) (1 V)
–Diferencijabilnost funkcija f:Rm–>Rn
. (1 P) (2 V)
–Derivacije duž vektora i parcijalne derivacije. Gradijent (1 P) (3 V)
–Diferencijal skalarnih i vektorskih funkcija. Matrični zapisi diferencijala (2 P) (2 V)
–Svojstva diferencijala (1 P) (1 V)
–Teorem o diferencijabilnosti kompozicije i primjene. Tangencijalna ravnina (2 P) (4 V)
–Neprekidna diferencijabilnost. Karakterizacija funkcija klase C1 (2 P) (1 V)
–Teoremi diferencijabilnog računa funkcija f:Rm–>Rn
(teoremi o srednjoj vrijednosti,
teoremi o implicitno zadanoj funkciji). (5 P) (4 V)
–Difeomorfizam. Teorem o inverznom preslikavanju. (2 P) (3 V)
–Diferencijali viših redova. Kvadratne i n–arne forme (2) (2 V)
–Taylorov teorem (2 P) (2 V)
–Lokalni ekstremi. Uvjetni ekstrem (2 P) (6 V)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td>Pohađanje nastave. Obavezna je nazočnost na barem 70% predavanja i vježbi.</td></tr>
<tr><td>Monitoring student work</td><td><table>
<tr><td>Class attendance</td><td>2.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2.5</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>2.5</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td>Ispit na kojem se rješavaju praktični i teorijski zadatci polaže se pismeno. Položeni pismeni ispit je uvjet za pristupanje usmenom ispitu. Pismeni ispit može se položiti i putem dvaju kolokvija tijekom nastave. Konačna ocjena se formira kao aritmetička sredina ocjene na pismenom dijelu ispita i ocjene na usmenom dijelu ispita. U slučaju neuspjeha na usmenom ispitu student ne mora ponovno pristupiti pismenom ispitu da bi stekao pravo (ponovnog) pristupa usmenome ispitu.</td></tr>
<tr><td>Required literature</td><td><table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>N.Koceić Bilan, Osnove matematičke analize I, PMF, Split</td><td></td><td></td></tr>
<tr><td>Š. Ungar, Matematička analiza u Rn , Tehnička knjiga, Zagreb, 2003.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td>N. Uglešić, Matematička analiza II, Matematička anliza III,
W. Rudin, Principles of Mathematical Analysis, Mc–Graw Hill, New York, 1964.</td></tr>
<tr><td>Quality assurance</td><td>Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="7">Mathematical analysis in Rn II</td></tr>
<tr><td>ID</td><td>PMM158</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Tanja Vojković</td><td>Points value (ECTS)</td><td colspan="4">7.5</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>45</td><td>0</td><td>60</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">20%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">learn Riemann integral of a real function oftwo variablesover a rectangle and over a Jordan measurable set

learn fundamental theorems of integral calculus and compute double and triple integrals using various systems in plane and space

learn to calculate volume of solids, mass and the centre of gravity of three-dimensional solids

acquire basic knowledge about multiple integrals

learn to differ curve from the set admitting 1-parametrization and to differ surface from the set admitting 2-parametrization

gain an understanding of notions of the length of the curve, curve tangent, surface area, surface normal

learn to compute curvilinear integral and surface integral of a scalar and vector fields</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Successfully completed course Introduction to mathematical analysis and Differential and Integral Calculus I

Prerequisite course: Mathematical analysis in Rn I

Entry competences: students should be comfortable with using concepts from differential and integral calculus of functions of a single real variable</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Students will be able to:

define Riemann integral of real function of two variables over a rectangle and J-measurable sets

state, prove and apply theorems of integral calculus for scalar functions

compute double and triple integrals and apply them to calculation of volume, mass and the centre of gravity of the solid body

describe the generalization of the definition of multiple integral to vector functions

differ curve from the set admitting 1-parametrization

differ surface from the set admitting 2-parametrization

define the curve rectifiability, surface area, curve tangent

calculate line integral and surface integral of scalar and vector fields

apply classical theorems of vector analysis to calculation of line and surface integrals</td></tr>
<tr><td>Syllabus</td><td colspan="6">Riemann integralof real functions oftwo variablesover arectangular. Jordan measurable sets, sets of measure zero. Lebesgue's criterion for Riemann integrability. Riemann integralof real functions oftwo variablesover a Jordan measurable sets. Fubini's theorem and functions defined by integrals. The change of variable theorem. Multiple integrals (20) (exc. 28)

1-parametrization of sets in Rn. Curve. Arc. Curve orientation. Rectifiability of a curve. Curve length. Smooth curves. Curve tangent. 2-parametrization of sets in R3.</td></tr>
</table>

	Surface. Smooth surface. Surface orientation. Surface area. Line integral of scalar and vector fields. Green's theorem. Differential forms. Surface integral of scalar and vector fields. Stokes' theorem. Gauss' theorem. (25) (exc. 32)						
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises		☐ Fieldwork ☑ Individual assignments ☐ Multimedia		☐ ☐		
	☐ Fully online ☐ Combined online		☐ Laboratory ☐ Mentoring		☐ ☐		
Student obligations	Class attendance.						
Monitoring student work	Class attendance	2.5	Research		Practical work		
	Experimental work		Paper				
	Essay		Seminar paper				
	Colloquiums		Oral exam	2.5			
	Written exam	2.5	Project				
Assessment and evaluation of student work	Students will have problem solving sessions that is evaluated in the overall grade, but are not a prerequisite for successful completion of the course. The final exam is taken in written and oral form. A positively graded written part of the exam is a prerequisite for taking the oral part of the exam. The written part can also be passed by partial exams.						
Required literature	Title				Number of copies available	Availability on other medium	
	Š. Ungar: Matematička analiza u Rn, Golden Marketing-Tehnička knjiga, Zagreb 2005.						
Supplementary literature	M. Lovrić, Vector Calculus, Addison-Wesley Publ. Ltd., Don Mills, Ontario, 1997. S. Lang, Calculus of Several Variables, Springer Verlag, 1993. S. Kurepa, Matematička analiza 3: Funkcije više varijabli, Tehnička knjiga, Zagreb, 1984. W. Rudin, Principles of Mathematical Analysis, McGraw - Hill,1964.						
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split						
Other (in the opinion of the proponent)							

Subject name	Mathematical Logic		
ID	PMM110	Study year	2.
Lecturer	prof. dr. sc. Milica Klaričić Bakula	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	10%
Subject description			
Subject goals	Students will: – learn basic concepts and results in Mathematical Logic – gain a deeper insight in foundations of mathematics – learn to write complete, coherent, concise proofs demonstrating mathematical rigor using various techniques: directly, indirectly and by induction – learn how to define a first order theory axiomatically which will give them a good preparation for Set Theory and Geometry.		
Enrolment requirements	Entry competences: elementary set theory.		
Learning outcomes	Upon successful completion of this course students will be able to: – evaluate the development of Mathematical Logic in terms of its relation to the foundations of Mathematics – define syntax and semantics of Propositional Logic – define axiomatically Propositional Logic (Propositional Calculus PC and Deductive Calculus DC) – state the following metatheorems, give their proofs and explain their meaning for PC and DC: The Soundness Theorem, The Completeness Theorem, The Compactness Theorem, The Deduction Theorem – define first order theories and explain the position of First Order Logic among them – define axiomatically First Order Logic (Predicate Calculus PC) – state the following metatheorems, give their proofs and explain their meaning for first order theories : The Soundness Theorem, The Completeness Theorem, The Compactness Theorem, The Deduction Theorem – using resolution or tableau test satisfiability, validity and logical consequence – for a formula find its prenex normal form, disjunctive normal form and conjunctive normal form – give a formal proof of a formula within a calculus (PC or PD) – give some well-known examples of first order theories (theory with equality, Peano Arithmetic, Set Theory)		
Syllabus	– Introduction: historical overview (1) – Propositional Logic: syntax and semantics (2) – Normal forms (2) – Validity tests (1) – Propositional Calculus (2) – Metatheorems for PC (2) – The Completeness Theorem and consequences (2) – Deductive Calculus (3) – Alternative axiomatizations and some non-classical propositional logics (1) – First order theories. syntax and semantics (3) – Prenex normal form (1) – Tableau (2) – Predicate Calculus (1) – Metatheorems for first order theories (2) – The Completeness Theorem and consequences (1) – First order theories: examples (4)		
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☑ problem sets ☐ ☐ ☐
Student obligations	Lectures and exercises.		
Monitoring student work	Class attendance: 2	Research:	Practical work:

	Experimental work		Paper		problem sets	0.5
	Essay		Seminar paper			
	Colloquiums	1.5	Oral exam	1		
	Written exam		Project			

Assessment and evaluation of student work	Two partial written exams / one final written exam and final oral exam.

Continuous assessment		
Evaluation elements	Performance (min)	Weight in grade (%)
problem sets	50	10
partial written exams	50	50

Final assessment		
Evaluation elements	Performance (min)	Weight in grade (%)
oral exam	50	40

Required literature	Title	Number of copies available	Availability on other medium
	M. Vuković, Matematička logika 1, PMF, Zagreb, 2007.	10	e-learning

Supplementary literature	1. D. van Dalen, Logic and Structures, Springer-Verlag, 1997. 2. H. D. Ebinghaus, J. Flum, W. Thomas, Mathematical Logic, Springer-Verlag, 1984. 3. A. G. Hamilton, Logic for Mathematicians, Cambridge University Press, 1988. 4. E. Mendelson, Introduction to Mathematical Logic, D. Van Nostrand Company, Inc. Princeton, 1997. 5. J. R. Shoenfield, Mathematical Logic, Addison-Wesley, Massachusetts, 1973.
Quality assurance	Summary feedback for the whole class after the exam. Anonymous student surveyniversity of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="6">Mathematical theory of Computation</td></tr>
<tr><td>ID</td><td>PMM612</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Milica Klaričić Bakula</td><td>Points value (ECTS)</td><td colspan="4">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>45</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">25%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">The aim of this course is to introduce basic concepts and results in theory of computation, in particular the theory of formal languages, automata theory, and computability. To conduct a rigorous study of computation, computer scientists work with a mathematical abstraction of computers called a model of computation. There are several models, but the most common is the Turing machine. Students should make a connection between the intuitive concept of the algorithm and the Church-Turing thesis and its consequences. What makes one problem computationally complex and another problem simple? We cannot answer this question, but students should be able to classify computational problems according to their complexity. Closely related to the notion of complexity is the notion of decidability: students learn to distinguish decidable problems from undecidable ones. By the end of this course, students should be able to understand the meaning of Hilbert's tenth problem and the idea of proving Gödel's incompleteness theorems.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Enrolment requirements: Mathematical Logic.
Entry competences: sets and relations; functions; axiomatic set theory; mathematical proofs (in particular proofs by various types of induction); first order theories, first order logic.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Upon successful completion of this course, students will be able to:
- construct FA that recognizes a given language or grammar, and formulate a regular expression that describes the language recognized by a given FA
- construct a PDA that recognizes a given CF language
- decide if a language is regular or CF
- construct a Turing machine that accepts/decides a language or compute a function
- for a given grammar (RLG, CF, CS) find the language it produces and vice versa
- differentiate decidable from undecidable problems
- prove undecidability by reduction
- prove that a function is recursive or primitive recursive
- define and explain the time complexity of Turing machines, the complexity classes P and NP, and NP-completeness
- prove NP-completeness by reduction</td></tr>
<tr><td>Syllabus</td><td colspan="6">- Partial orders. Complete partial orders. Fixed Point Theorem (2)
- Deterministic finite automata (DFA) and their languages (2)
- Non-deterministic finite automata (NFA) and their languages; Equivalence of DFA and NFA (2)
- NFA with empty transitions (1)
- Regular languages (RL). Pumping Lemma (2)
- Class RL. RL= FAL (2)
- Decision algorithms for RL (1)
- Minimization of FA (1)
- Context-free languages. Class KFL (1)
- Pumping Lemma for KFL (1)
- Right-linear languages. Class RLL (2)
- RLL = RL (1)
- Algebraic laws for regular expressions (2)
- Push-down automata (PDA) (2)
- Turing machine (TM): motivation, informal and formal definition, TM languages (2)
- Variants of Turing machines and their equivalence (4)
- Informal and formal definition of algorithm, Church-Turing thesis (1)
- Recursively enumerable languages, recursive languages (2)
- Unrestricted grammars, context-sensitive grammars(2)
- Decision problems, important undecidable problems (4)
- Primitive recursive functions, recursive functions (4)
- Computable functions vs recursive functions (2)
- Complexity classes P and NP (2)</td></tr>
</table>

Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring	☑ Problem sets ☐ ☐ ☐
Student obligations	Attending classes with active participation in problem sessions. Individual work on exercises, in addition to group work in class, is essential for understanding the material.		

Monitoring student work						
Class attendance	2.5	Research		Practical work	
Experimental work		Paper		Problem sets	0.5
Essay		Seminar paper			
Colloquiums	1.5	Oral exam	1.5		
Written exam		Project			

Assessment and evaluation of student work

Final written exam (or two partial exams), and final oral exam: equally evaluated in the final grade. Problem sets.

Continuous assessment		
Evaluation elements	Performance (min)	Weight in grade (%)
partial written exams	50	50
problem sets	50	20

Final assessment		
Evaluation elements	Performance (min)	Weight in grade (%)
oral exam	50	30

Required literature

Title	Number of copies available	Availability on other medium
J. Martin, Introduction to Languages and the Theory of Computation, McGraw Hill, 2010		e-learning
M. Sipser, Introduction to the Theory of Computation, PWS Publishing Company, 1996.		e-learning

Supplementary literature	1. J. E. Hopcroft, R. Motwani, J. D. Ullman, Introduction to Automata Theory, Languages and Computation, Addison Wesley 2001.. 2. K. R. Apt, E. R. Olderog, Verification of Sequential and Concurrent Programs, Springer 1991. 3. Moll, Arbib and Kfoury, Introduction to Formal Language Theory, Springer 1988.
Quality assurance	Summary feedback for the whole class after the exam. Anonymous student survey.
Other (in the opinion of the proponent)	

Subject name	Mathematical methods of physics I		
ID	PMP107	Study year	2.
Lecturer	izv. prof. dr. sc. Bernarda Lovrinčević	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 45, S: 15, E: 30, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description

Subject goals	To teach students to use methods of vector and tensor analysis as well as probability and statistics in analysis and solving of physics problems.
Enrolment requirements	Calculus in one variable
Learning outcomes	1. Formulate the action of differential vector operator nabla on scalar and vector fields in any orthogonal coordinate system and discuss the interpretation of obtained quantities in physical systems. 2. Choose optimal procedure when calculating physical quantities (using Gauss's, Stokes' and Green's theorem, directional derivative and mathematical identities) 3. Formulate basic operators and theorems of tensor analysis and apply them in different areas, such as mechanics or electrodynamics 4. Apply basic concepts of probability theory and use permutations, combinations and variations in calculations. 5. Calculate basic statistical parameters of a series of data (mean value, standard deviation, estimation of errors), recognise when it is possible to fit data using least squares method and use the calculation of correlations in statistical analysis. 6. Describe properties of discrete and continuous random variables. 7. Enumerate basic methods for parameter estimation, define likelihood function and apply hypothesis testing (e.g. chi-square test).
Syllabus	1. Curved coordinates. Gradient. Directional derivative. (5h) 2. Divergence. Curl. (6h) 3. Vector integration. Gauss's Theorem. Stokes Theorem. (6h) 4. Gauss's law and Poisson's Equation. Multiple applications of nabla (6h) 5. Dirac Delta Function. (6h) 6. Differential Vector Operators in orthogonal coordinates. Examples in spherical and cilindrical coordinates. (6h) 7. Introduction to Tensor Analysis. Contraction and direct product. Quotient Rule. (8h) 8. Tensors in general coordinates. Covariant derivatives. (8h) 9. Basics in combinatorics. (6h) 10. Elements of the probability theory: random events, dependence and independence. (6h) 11. Random variables and probability distributions (10h) 12. Basic statistical parameters of data series. Propagation of errors. Least squares method. (7h) 13. Statistical estimation of parameters. Testing statistical hypothesis. (10h)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Active participation during class attendance.

Monitoring student work						
	Class attendance	3	Research		Practical work	
	Experimental work		Paper		Independent work and exam	3
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project			

Assessment and evaluation of student work	Colloquia and final exam.		
Required literature		Number	

	Title	of copies available	Availability on other medium
	1. L. Vranješ Makrić, Skripta iz matematičkih metoda fizike I, lecture notes, 2009. Moodle Web page		yes
	2. PP Presentations in probability and statistics		yes
Supplementary literature	1. K. F. Riley, M. P.Hobson, S. J. Bence, Mathematical methods for physics and engeneering. 2. H. J. Weber , G. B. Arfken, G. Arfken, Essential Mathematical Methods for Physicists, Academic Press, 2003.		
Quality assurance	– following the success of students in colloquia and exam – following the student success in the following exams and the connection to the success of this course – student surveys		
Other (in the opinion of the proponent)			

Subject name	Mathematical Methods of Physics II		
ID	PMP101	Study year	2.
Lecturer	izv. prof. dr. sc. Željana Bonačić Lošić	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 45, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	0%
Subject description			
Subject goals	The understanding and the ability to apply appropriate mathematical methods to analyze and solve physical problems.		
Enrolment requirements	Mathematics I and Mathematics II.		
Learning outcomes	1. Derive and integrate functions of a complex variable. 2. Expand complex functions in series, which includes Taylor series, analytical extension of a function, analysis of poles of a function and Laurent series. 3. Derive the theorem of residues and apply it to solving the integrals in real and complex area using different forms of integration curves. 4. Calculate the sum of the series using integration in the complex domain. 5. Define the gamma function, connect it with frequently used distributions in physics and apply it in other practical calculations. 6. Expand the periodic function into a Fourier series and add the Fourier series. 7. Use integral transformations such as Fourier, Laplace and others, when solving physical problems. 8. In practical calculations, use the delta function in one and more dimension, and with a simple and complex argument. 9. Explain the origin and characteristics of chaotic behavior of dynamic systems.		
Syllabus	Functions of a complex variable (5 hours). Cauchy -Riemann Conditions (5 hours). Analytic Functions (5 hours). Cauchy's Integral Theorem (5 hours). Cauchy's Integral Formula (5 hours). Laurent Expansion (5 hours). Singularities (5 hours). Calculus of Residues (5 hours). Evaluation of Definite Integrals (12 hours). Fourier series (10 hours). Fourier transformation (10 hours). Introduction to Nonlinear Methods and Chaos. Logistic map. Sensitivity to Initial Conditions and Parameters (3 hours).		
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☑ Frontal lectures using interactive simulations and computing examples. Problem solving analytically and with computer in exercise classes. Giving problems to students for home exercise. ☐ ☐ ☐

<table>
<tr><td>Student obligations</td><td colspan="6">Attendance at lectures and exercises and activity during classes. Solving homework. Going to written and oral colloquiums. Taking the written and oral part of the exam.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>2.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1.5</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">The final grade is the average of the grades from the written and oral parts of the exam. Students can pass the written and oral part of the exam through several colloquia during the semester.</td></tr>
<tr><td rowspan="3">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">1. H. J. Weber , G. B. Arfken, G. Arfken, Essential Mathematical Methods for Physicists, Academic Press, 2003.</td><td>1</td><td>on-line</td></tr>
<tr><td colspan="4">2. G. B. Arfken, H. J. Weber, Mathematical Methods for Physicists, Academic Press, 2005.</td><td>2</td><td>on-line</td></tr>
<tr><td>Supplementary literature</td><td colspan="6">1. K. F. Riley, M. P. Hobson, S. J. Bence, Mathematical methods for physics and engeneering, Cambridge University Press, 2006.
2. E. Butkov, Mathematical physics, Addison - Wesley Publishing Company Inc., 1968.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Student surveys.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

Subject name	Mathematical Methods of Physics III						
ID	PMP102	Study year	3.				
Lecturer	izv. prof. dr. sc. Petar Stipanović izv. prof. dr. sc. Larisa Zoranić	Points value (ECTS)	5.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	30	0	
Subject status	Compulsory	Online percentage	10%				

Subject description

Subject goals	Knowledge and skills in the numerical methods and their implementation, including the methods of linear algebra and numerical analysis, applied in solving problems in physics.
Enrolment requirements	Basic knowledge of programming (C or C++), mathematical analysis, linear algebra and general physics.
Learning outcomes	1. Apply numerical methods to obtain approximate solutions to mathematical problems such as interpolation, differentiation and integration. 2. Develop a critical understanding of the capabilities and limits of the various numerical methods and correctly estimate numerical errors. 3. Solve ordinary and partial differential equations frequently encountered in physics in some simple cases. 4. Formulate, computationally solve and present results for simple problems in physics.
Syllabus	Practical exercises on the computer follow lectures with the same schedule according to the following content with applications in physics. INTRODUCTION TO NUMERICAL METHODS (2h) Introduction to the course. Reminder of programming basics: recursive relations, numerical errors. (2h) Solving a system of homogeneous linear equations by the method of Gauss-Jordan elimination with pivoting. Three-diagonal system of linear equations. (2h) Numerical derivation. (2h) Root-finding algorithms: bisection method and Newton-Raphson method. APPROXIMATION AND INTERPOLATION (2h) Approximations and polynomial interpolation. Lagrange interpolating polynomial. (2h) Neville's algorithm. (2h) Cubic spline interpolation. NUMERICAL INTEGRATION (2h) Newton-Cotes quadrature. Equally spaced points. Trapezoidal rule. Simpson's rule. (2h) Gauss-Legend quadrature. Legendre polynomials. Laguerre polynomials. Hermite polynomials. ORDINARY DIFFERENTIAL EQUATIONS (1h) Introduction to differential equations. Numerical solution of motion equations. (1h) Euler's method. Predictor-corrector method. Visualization. (2h) Runge-Kutta method. Harmonic oscillations. PARTIAL DIFFERENTIAL EQUATIONS (4h) Explicit and implicit scheme. 1D diffusion equation. (2h) Crank-Nicolson method. Wave equation. (2h) Elective topic. Project tasks.
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Active participation in classes and assignments. Solving given physics problems and project and its presentation.

Monitoring student work						
	Class attendance	2	Research		Practical work	1
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums	1	Oral exam			

	Written exam		Project	1		

Assessment and evaluation of student work	The conditions for passing the exam are: – completed mandatory assignments given during lectures and exercises, – passed colloquia or written exam; while a project is elective for a higher grade. The grade is formed according to the evaluation of the student's activity, the grade of the practical exams and the grade of the project.

Required literature	Title	Number of copies available	Availability on other medium
	[1] Morten Hjorth-Jensen: "Computational Physics", Lecture Notes, University of Oslo, 2007, 2015.		yes
	[2] W. H. Press, S. A. Teukolsky, W. T. Vetterling & B. P. Flannery: Numerical Recipes in C / C++, The Art of Scientific Computing, Cambridge, 2002, 2007. University Press		yes
	[3] K. Ćosić, P. Marendić: "Naučite programirati uz C++", Element, 2009, 2014.	9	no
	[4] Leandra Vranješ Markić: "Matematičke metode fizike I", skripta, PMFST, Split, 2009.		yes
	[5] Digitalni materijali s predavanja (P. Stipanović, L. Zoranić).		yes

Supplementary literature	[6] H. J. Weber , G. B. Arfken, G. Arfken, Essential Mathematical Methods for Physicists, Academic Press, 2003. [7] B. W. Kernighan & D. M. Ritchie "The C programing langauge", Prentice Hall, USA, 1998. [8] Z. Drmač, V. Hari, M. Marušić, M. Rogina, S. Singer & S. Singer: Numerička analiza, skripta, PMF, Zagreb, 2003. [9] Cplusplus.com: "C++ Language", Tutorial, http://www.cplusplus.com/doc/tutorial/ [10] Scientific papers.
Quality assurance	Lecturers who teach subjects, which have correlated learning outcomes, collaborate and take care of teaching quality. Discussion with students and analyzing their progress in solving problem and project tasks. Statistics of exam results and evaluation of efficacy in accordance with the learning outcomes. Student evaluation by anonymous survey conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Matematički programski alati I</td></tr>
<tr><td>ID</td><td>PMM017</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Jurica Perić</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 0
S: 0
E: 30
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3"></td></tr>
<tr><td>Enrolment requirements</td><td colspan="3"></td></tr>
<tr><td>Learning outcomes</td><td colspan="3"></td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3"></td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance | | Research | | Practical work |
Experimental work | | Paper | | |
Essay | | Seminar paper | | |
Colloquiums | | Oral exam | | |
Written exam | | Project | | |</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3"></td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
–</td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	athematical program tools II		
ID	PMM018	Study year	3.
Lecturer	doc. dr. sc. Andrijana Ćurković	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	30%

Subject description	
Subject goals	Competence in the use of Scilab. Competence in the use of Octave.
Enrolment requirements	
Learning outcomes	The student is able to: define basic objects using Scilab and Octave (functions, lists, matrices) solve mathematical problems using Scilab and Octave create graphics for functions of two and three variables with the change of features of the graphics using Scilab and Octave solve ordinary and partial differential equations using Scilab demonstrate the behavior of mathematical models using simulation in Scilab design animation in Scilab modify algorithms for implementation in Scilab and Octave
Syllabus	Introduction to Scilab and its possibilities – 2 hours Matrices – 2 hours Graphics – 4 hours First partial exam – 1 hour Functions. Branching instructions. Loops – 2 hours Data types – 2 hours. Second partial exam – 1 hour Differential calculus – 2 hours Differential equations – 2 hours Third partial exam – 2 hours Introduction to Octave and its possibilities – 2 hours Basic data types – 2 hours Functions. Branching instructions. Loops. – 2 hours Fourth partial exam – 1 hour Graphics – 2 hours Fifth partial exam – 1 hour
Teaching types	☐ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	

Monitoring student work

Class attendance	0.5	Research		Practical work	1.5
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	During the course students work on the computer is monitored. The exam is taken using a computer and consists of five partial exams during the semester (3 partial exams in Scilab, 2 partial exams in Octave).

Required literature

Title	Number of copies available	Availability on other medium
–		

Supplementary literature	
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the	

proponent)	

Subject name	Mathematical program tools II		
ID	PMM018	Study year	3.
Lecturer	doc. dr. sc. Andrijana Ćurković	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	50%

Subject description

Subject goals	Competence in the use of MATLAB or similar mathematical tools suach as Scilab or Octave
Enrolment requirements	
Learning outcomes	The student is able to: define basic objects in software tool (functions, lists, matrices) create user defined function use a software tool for visualization solve mathematical problems using software tool use the built-in functions in MATLAB for simple numerical calculations customize algorithms for implementation in software tool Differential equations. - 2 hours Introduction to Simulink. - 2 hours
Syllabus	Introduction to software tools and its possibilities. - 2 hours Variables. Functions. Built-in functions. Program flow control. - 3 hours MATLAB programming: scripts and functions. - 3 hours Graphics. - 4 hours Matrix calculus. Examples of using numerical linear algebra. - 6 hours Differential and integral calculus. - 2 hours Nonlinear equations. - 4 hours Differential equations. - 2 hours Introduction to Simulink. - 2 hours
Teaching types	☐ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	

Monitoring student work

Class attendance	0.5	Research		Practical work	1.5
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	During the course students work on the computer is monitored. The exam is taken by solving project tasks using a computer. Depending on the conditions, project tasks are solved at home or during classes. Project assignments done at home are defended on an oral test.

Required literature

Title	Number of copies available	Availability on other medium
Software tool manual		

Supplementary literature	
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Materials</td></tr>
<tr><td>ID</td><td>PMT154</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Ivan Peko</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td><table><tr><td>L</td><td>S</td><td>E</td><td>P</td></tr><tr><td>45</td><td>0</td><td>15</td><td>0</td></tr></table></td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Adopting basic knowledge of materials for the purpose of education in primary and secondary schools</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Define the types of chemical bonds and crystal systems
2. Explain the process of crystallization and characteristics of individual crystal structures
3. Analyze the basic phase diagrams
4. Define conditions occurrence of certain structural phase Fe-C alloy
5. Characterize polymer, composite and ceramic materials
6. Define the basic procedures of heat treatment of metal materials
7. List the basic properties and areas of application of certain technical materials
8. Explain methods of testing materials
9. Create awareness about the importance of recycling materials, their care, and environmental protection</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Introduction to the course and basic concepts
2. The structure of matter - the amorphous and crystalline structures
3. Crystallization of metals
4. Phase Diagrams
5. Phase diagram Fe-C
6. Iron, steel
7. Non-ferrous metals and alloys
8. Colloquium
9. Non-ferrous metals
10. Polymers
11. Ceramic materials
12. Composite materials, wood and stone
13. Heat treatment of materials
14. Material recycling, disposal of materials
15. Colloquium</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Class attendance, homework (programs), independent study and literature reading, accessing colloquium and/or written and oral examination.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table><tr><td>Class attendance</td><td>2.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr><tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr><tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr><tr><td>Colloquiums</td><td>0.5</td><td>Oral exam</td><td>1</td><td></td><td></td></tr><tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Class attendance is registered, but not included in the evaluation. Exam and partial exam consists of a theoretical part and assignments. - Theoretical exam (50%) - Assignments (50%) Passing threshold is 50%.</td></tr>
<tr><td>Required literature</td><td colspan="3"><table><tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr><tr><td>Materijali - predavanja (interna skripta) Mr.sc. Goran Fučko</td><td></td><td></td></tr><tr><td>Deželić R, osnove konstrukcijskih materijala, Fesb, Split</td><td></td><td></td></tr></table></td></tr>
</table>

Supplementary literature	Anzulović B., Materijali, FESB, Split
Quality assurance	Conducting an anonymous student surveys, talk with students, analyses the success of students on tests and exams, self-assessment.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="6">Mechanics</td></tr>
<tr><td>ID</td><td>PMP001</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Ante Bilušić</td><td>Points value (ECTS)</td><td colspan="4">9.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>60</td><td>15</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">20%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Understanding the basics of mechanics.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Completion of four years of secondary school, i.e. graduation at the level 4.2 or higher, and passing examinations in compulsory and elective subjects of the state matriculation examination in accordance with the decisions of the higher education institution directing the studies.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. Define basic physical quantities and the corresponding units of measurement based on seven fixed values of natural constants, compare basic and derived and vector and scalar quantities.
2. Interpret the basic concepts of kinematics, especially the concepts of velocity and acceleration, and correctly apply and interpret the graphical representation of physical quantities and their interdependence.
3. Qualitatively and quantitatively analyze and compare different types of motion of a material point and a multibody system using Newton's postulates.
4. Analyze and interpret dynamic quantities (force, work, power, energy) and apply the law of conservation of momentum and the law of conservation of energy.
5. Compare the fundamentals of kinematics and dynamics of a rigid body, specifically analyze the conditions of equilibrium and rotation about fixed axes and the motion of the rigid body.
6. Analyze the motion of various types of harmonic oscillators.
7. Compare inertial and non-inertial systems, derive and apply the equation of motion of a particle in a non-inertial system, and analyze inertial forces in rotating systems.
8. Qualitative and quantitative analysis of the motion of a body in an inverse square force field.
9. Define fundamental concepts and describe phenomena from the field of relativistic mechanics.
10. Derive and describe the Euler equation, the continuity equation, the Bernoulli and Navier-Stokes equations, and explain the difference between laminar and turbulent flow.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Lectures with demonstration experiments:
• (1 hour) Basic concepts of space and time; mathematical reminder of vectors and vector calculus
• Kinematics:
o (2 hours) linear and motion in two and three dimensions
o (2 hours) circular motion
• (1 hour) Aristotle's description of the body motion
• (3 hours) Newton’s laws
• (2 hours) Diagram of forces to free body (free fall and the vertical shot, horizontal and motion on the slope). The dynamics of system of the bodies
• (2 hours) Dynamics of circular motion
• Descriptions of the selected forces in nature:
o (3 hours) Gravitational force
o (2 hours) Elastic force
o (2 hours) Friction
• (2 hours) Inertial and non-inertial systems
• (2 hours) Rotating non-inertial systems
• (2 hours) Work and kinetic energy. Elastic and gravitational potential energy.
• (3 hours) Conservative and non-conservative forces. Conservation laws in isolated systems
• Collisions:
o (1.5 hours) Central elastic collision in laboratory and centre-of-mass systems
o (1.5 hours) Non-central elastic collision in laboratory and centre-of-mass systems
o (1 hour) Non-elastic central collision in laboratory and centre-of-mass systems
• (2 hours) Statics of the rigid body
• (2 hours) Steiner theorem. Main axis of the rigid body</td></tr>
</table>

	• (1 hour) Euler's equations • (2 hours) Rotation of the axial symmetric free body • (2 hours) Top motion. Angular momentum conservation law. • (3 hours) Periodic motion without and with damping • (2 hours) Forced pendulum • (1.5 hours) Fluid statics: atmospheric and hydrostatic pressure, buoyancy • Fluid dynamics: o (1 hour) Euler's, continuity, and Bernoulli's equation o (1.5 hours) Navier-Stokes equation. Surface tension. Aerodynamics • Mechanics of the solar system o (1 hour) Motion models of celestial bodies o Kepler's laws o (1 hour) Phenomena caused by the motion of the Earth and the Moon. Cosmic velocities, gravitational slingshot, Lagrange points • Special relativity o (2 hours) Michelson-Morley experiment. Lorentz transformations o (1 hour) Transformation of velocity and acceleration o (2 hours) Relativistic dynamics Exercises: • (2 hours) Vectors • (2 hours) Linear motion • (2 hours) Complex motions • (6 hours) Force. Newton's laws. • (2 hours) Reference systems • (2 hours) Work and energy • (2 hours) Momentum and energy conservation laws • (4 hours) Rigid body mechanics • (2 hours) Periodic motion • (2 hours) Fluid mechanics • (2 hours) Mechanics of the solar system • (2 hours) Special relativity Seminars: • (1 hour) Vectors • (1 hour) Linear motion • (1 hour) Complex motions • (3 hours) Force. Newton's laws. • (1 hour) Reference systems • (1 hour) Work and energy • (1 hour) Momentum and energy conservation laws • (2 hours) Rigid body mechanics • (1 hour) Periodic motion • (1 hour) Fluid mechanics • (1 hour) Mechanics of the solar system • (1 hour) Special relativity
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☑ Problems solving ☐ ☐ ☐
Student obligations	Solving homework assignments during the semester. Class participation.

Monitoring student work

Class attendance	3.5	Research		Practical work	
Experimental work		Paper		Problems solving (homeworks)	1
Essay		Seminar paper			
Colloquiums		Oral exam	2.5		
Written exam	2	Project			

Assessment and evaluation of student work	Twice during the semester, students take a written pre-exam (first part: kinematics, dynamics, systems of the body, the second part: energy, conservation laws, rigid body, oscillations, fluids). Students that reach more than 50% of possible points were acquitted of taking the written exam and can access the oral exam directly. Furthermore, those students that in the first written pre-exam achieve 50% points or

<table>
<tr><td></td><td>more, can take the oral exam in two parts (first part includes materials to the systems of the body, must be taken immediately after the first written pre-exam). The final grade is based on written (pre-)exam (1/2 of the score) and the oral exam (1/2 of the score).</td></tr>
<tr><td>Required literature</td><td><table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>Antonije Dulčić: Mehanika, Prirodoslovno-matematički fakultet u Zagrebu, (in Croatian)</td><td>0</td><td>yes (free access)</td></tr>
<tr><td>Halliday, Resnick, Walker: Fundamentals of Physics, John Wiley & Sons, 2003.</td><td>25</td><td>yes</td></tr>
<tr><td>E. Babić, R. Krsnik i M. Očko: Zbirka riješenih zadataka iz fizike, Školska knjiga, Zagreb 2004. (in Croatian)</td><td>10</td><td>no</td></tr>
<tr><td>P. Kulišić, L.Bistričić, D. Horvat, Z. Narančić, T. Petrović i D. Pevec. Riješeni zadaci iz mehanike i topline. Školska knjiga, Zagreb, 2002. (in Croatian)</td><td>5</td><td>no</td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td>[1] C. Kittel, W.P. Knight i M.A. Ruderman. Mehanika, Berkeleyski tečaj, I dio, Golden Marketig Tehnička knjiga, Zagreb 2003.
[2] R. P. Feynman, R. B. Leighton, M. Sands, The Feynman Lectures on Physics, vol. I, Addison-Wesley, 1978.
[3] I. E. Irodov: Problems in General Physics, Mir Publishers, Moscow</td></tr>
<tr><td>Quality assurance</td><td>1. Lecturers who have subjects with correlated learning outcomes work together to ensure quality of learning.
2. Statistics of test scores and assessment of performance in accordance with established learning outcomes.
3. Evaluation of students through an anonymous survey conducted in accordance with the regulations of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td></td></tr>
</table>

Subject name	Meteorology I		
ID	PMP161	Study year	1.
Lecturer	izv. prof. dr. sc. Jadranka Šepić	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 5, E: 15, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description

Subject goals	Provide knowledge of basic variables and processes in the atmosphere Provide knowledge on atmospheric thermodynamic processes Provide knowledge on equations describing dynamics and states of the atmosphere
Enrolment requirements	Basics of physics Basics of mathematics Basics of fluid mechanics Basic programming
Learning outcomes	Basic knowledge on atmospheric composition and structure Basic knowledge on relevant variables and processes in the atmosphere Basic knowledge on thermodynamic of dry and moist air Basic knowledge on atmospheric stability Basic knowledge on cloud formation and precipitation Basic knowledge on fundamental forces acting in the atmosphere Basic knowledge on basic equations
Syllabus	1. Atmospheric composition and atmospheric basics (2 hours of lectures) 2. Ais pressure; hydrostatic equilibrium (2 hours of lectures) 3. Thermodynamics of unsaturated air (3 hours of lectures) 4. Moisture variables (3 hours of lectures) 5. Thermodynamics of saturated air (4 hours of lectures) 6. Atmospheric stability (3 hours of lectures) 7. Clouds and precipitation (5 hours of lectures) 8. Fundamental forces (4 hours of lectures) 9. Equation of movement, equation of continuity, heat conservation law (4 hours of lectures) 11. Scaling analysis. Geostrophic balance and geostrophic wind (2 hours of lectures) 12. Component equations in other coordinates (2 hours of lectures)
Teaching types	[x] Lectures [ ] Seminars [x] Exercises [ ] Fully online [ ] Combined online [x] Fieldwork [ ] Individual assignments [ ] Multimedia [ ] Laboratory [ ] Mentoring [x] Homework assignments [ ] [ ] [ ]
Student obligations	Attend at least 70% of lectures and 70% of exercises.

Monitoring student work

Class attendance	1.5	Research		Practical work	
Experimental work		Paper		Homework assignments	1
Essay		Seminar paper			
Colloquiums		Oral exam	1.5		
Written exam	1	Project			

Assessment and evaluation of student work	Twice during the semester students take preliminary exams (the first preliminary exam consists of the first eight lessons; and the second one of the last four lessons). Students who acquire more than 50% at preliminary exams are exempt from the written exam. Students receive and submit homework during the course. The final grade is formed based on the written exam (or preliminary exams) (40%), homework (20%) and oral exam (40%).

Required literature

Title	Number of copies available	Availability on other medium
Roland B. Stull Practical Meteorology - An Algebra-based Survey of Atmospheric Sciencecs	0	da

Supplementary literature	James R. Holton & Gregory J. Hakim An Introduction to Dynamic Meteorology Academic Press, 2013.
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Meteorology II						
ID	PMP260	Study year	1.				
Lecturer	izv. prof. dr. sc. Jadranka Šepić	Points value (ECTS)	5.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	15	0	
Subject status	Compulsory	Online percentage	0%				

Subject description

Subject goals	provide knowledge on dynamical and physical processes in the atmosphere provide knowledge on general circulation of the atmosphere provide knowledge on synoptic processes provide knowledge on fronts and air masses
Enrolment requirements	Meteorology 1 Introduction to Fluid Mechanics Programming
Learning outcomes	gaining knowledge on dynamical processes in the atmosphere gaining knowledge on general circulation of the atmosphere gaining knowledge on synoptic-scale dynamics gaining knowledge on fronts and air masses gaining knowledge on atmospheric waves
Syllabus	1. Winds in the atmosphere: geostrophic wind (2 hours of lectures) 2. Gradient wind (2 hours of lectures) 3. Winds in atmospheric boundary layer (2 hours of lectures) 4. Cyclostrophic and gradient wind (2 hours of lectures) 5. General circulation of the atmosphere: surface circulation, upper troposphere circulation, vertical circulation (2 hours of lectures) 6. General circulation of the atmosphere - drivers: differential heating, vertical pressure profiles, hydrostatic thermal circulation (3 hours of lectures) 7. General circulation of the atmosphere: conceptual model (4 hours) 8. Barotropic and baroclinic atmosphere (2 hours of lectures) 9. Rossby waves (2 hours of lectures) 10. Fronts and air masses: genesis and movement (5 hours)

Teaching types			
	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☑ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☑ Homework assignments ☐ ☐ ☐

Student obligations	Attend at least 70% of lectures and 70% of exercises.

Monitoring student work						
	Class attendance	1.5	Research		Practical work	
	Experimental work		Paper			1
	Essay		Seminar paper			
	Colloquiums		Oral exam	1.5		
	Written exam	1	Project			

Assessment and evaluation of student work	Twice during the semester, students take preliminary exams (the first preliminary exam consists of the first six lessons, and the second one of the last seven lessons). Students who acquire more than 50% at preliminary exams are exempt from the written exam. Students receive and submit homework during the course. The final grade is formed based on the written exam (or preliminary exams) (40%), homework (20%), and oral exam (40%).

Required literature	Title	Number of copies available	Availability on other medium
	James R. Holton & Gregory J. Hakim An Introduction to Dynamic Meteorology Academic Press, 2013.	2	no
	Roland B. Stull Practical Meteorology - An Algebra-based Survey of Atmospheric Sciencecs	0	yes

Supplementary literature	Roland B. Stull An Introduction to Boundary Layer Meteorology Kluwer, 1988.
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="4">Chemistry Education Practice and Seminar I</td></tr>
<tr><td>ID</td><td>PMC216</td><td>Study year</td><td colspan="2">2.</td></tr>
<tr><td>Lecturer</td><td>dr. sc. Roko Vladušić, v. pred.</td><td>Points value (ECTS)</td><td colspan="2">2.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td colspan="2">L: 0
S: 15
E: 30
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="2">10%</td></tr>
<tr><td colspan="5">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="4">The aim of the course is implementation and incensement of pedagogical content (chemistry) knowledge through preparation, conduction and analysis of chemistry instruction provided in elementary school.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="4">Chemistry Education I obligations completed (except exam); starting competencies are related to the basic Pedagogical content (chemistry) knowledge.</td></tr>
<tr><td>Learning outcomes</td><td colspan="4">After fulfilling all obligations, students, regarding curriculum of elementary school chemistry, will be able to:
– design lessons for chemistry instruction,
– conduct chemistry instruction,
– apply adequate strategies and teaching methods,
– evaluate pupils’ knowledge and skills,
– communicate with pupils in positive way and
– analyse efficiency of teaching process</td></tr>
<tr><td>Syllabus</td><td colspan="4">Students are going to be involved in chemistry instruction and perform lessons according to the curriculum of chemistry for elementary schools (30 hours of practice).
Students will analyse lessons’ performance, discuss observed elements of Pedagogical Content (Chemistry) Knowledge and do seminar activities related to Chemistry misconception (15 hours of seminar).</td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☑ Combined online</td><td colspan="2">☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☑ Teaching practice
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="4">Participation in chemistry instruction in elementary school, conduction of chemistry lessons in school, accomplishment and analysis of task related to the Pedagogical content (chemistry) knowledge and Chemistry misconceptions.

In school, student have to conduct at least two probe lectures and a public lecture. Also, student must follow the work of mentor and take a part in different teaching and school related non-teaching activities.</td></tr>
<tr><td>Monitoring student work</td><td colspan="4">
<table>
<tr><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Praćenje nastave u osnovnoj školi</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td>Provedba nastavnih sati</td><td>1</td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td>Obrada i analiza metodičkog uradka</td><td>0.5</td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="4">Preparation, conduction and analysis of lessons – 80 % Accomplishment and analysis of task related to the Pedagogical content (chemistry) knowledge – 20 %</td></tr>
<tr><td>Required literature</td><td colspan="4">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Chemistry textbooks approved by Ministry of Science and Education.</td><td></td><td></td></tr>
<tr><td>Sikirica, M. (2004). Metodika nastave kemije, Školska knjiga, Zagreb.</td><td></td><td></td></tr>
</table>
</td></tr>
</table>

Supplementary literature	Sikirica, M. (2011). Zbirka kemijskih pokusa za osnovnu i srednju školu, Školska knjiga, Zagreb. Taber, K. (2002). Chemical misconceptions – prevention, diagnosis and cure, Volume 1: Theoretical background, London. Taber, K. (2002). Chemical misconceptions – prevention, diagnosis and cure, Volume 2: Classroom resources, London.
Quality assurance	Personal consultations, individual tasks analysis, group conversation, institutional evaluation at the end of the semester.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Chemistry Education Practice and Seminar II</td></tr>
<tr><td>ID</td><td>PMC215</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>dr. sc. Roko Vladušić, v. pred.</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 0
S: 15
E: 30
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The aim of the course is implementation and incensement of pedagogical content (chemistry) knowledge through preparation, conduction and analysis of chemistry instruction provided in secondary schools.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Chemistry Education II and Laboratory in Chemistry Education I obligations completed (except exam); starting competencies are related to the basic Pedagogical content (chemistry) knowledge.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After fulfilling all obligations, students, regarding chemistry curriculum for secondary schools, will be able to:
– design lessons for chemistry instruction,
– conduct chemistry instruction,
– apply adequate strategies and teaching methods,
– evaluate pupils' knowledge and skills,
– communicate with pupils in positive way and
– analyse efficiency of teaching process</td></tr>
<tr><td>Syllabus</td><td colspan="3">Students are going to be involved in chemistry instruction and perform lessons according to the chemistry curriculum for secondary schools (30 hours of practice).
Students will analyse lessons' performance, discuss observed elements of Pedagogical Content (Chemistry) Knowledge and do seminar activities related to Chemistry misconception (15 hours of seminar).</td></tr>
<tr><td>Teaching types</td><td colspan="3">☐ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☐ Laboratory
☑ Mentoring
☑ metodičke vježbe
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Participation in chemistry instruction in secondary schools, conduction of chemistry lessons in school, accomplishment and analysis of task related to the Pedagogical content (chemistry) knowledge and Chemistry misconceptions.

In school, student have to conduct at least two probe lectures and a public lecture. Also, student must follow the work of mentor and take a part in different teaching and school related non-teaching activities.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td>0.5</td><td>Praćenje nastave u srednjoj školi</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td>Own lecture performance</td><td>1</td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td>PCK taskdičkog uradka</td><td>0.5</td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Preparation, conduction and analysis of lessons – 80 % Accomplishment and analysis of task related to the Pedagogical content (chemistry) knowledge – 20 %</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Chemistry textbooks approved by Ministry of Science and Education.</td><td></td><td></td></tr>
<tr><td>Sikirica, M. (2004). Metodika nastave kemije, Školska knjiga, Zagreb.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Sikirica, M. (2011). Zbirka kemijskih pokusa za osnovnu i srednju školu, Školska knjiga, Zagreb.</td></tr>
</table>

	Taber, K. (2002). Chemical misconceptions – prevention, diagnosis and cure, Volume 1: Theoretical background, London. Taber, K. (2002). Chemical misconceptions – prevention, diagnosis and cure, Volume 2: Classroom resources, London.
Quality assurance	Personal consultations, individual tasks analysis, group conversation, institutional evaluation at the end of the semester.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Physics Education III</td></tr>
<tr><td>ID</td><td>PMP250</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Mile Dželalija</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 30
E: 30
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">• To capacitate students in lecture plan writing and teaching lessons in physics in high school using different teaching tools.
• To develop the ability of evaluation of pupil’s conceptual knowledge in physics.
• To be acquainted with the possibilities and demands of evaluation on a large scale.
• To develop knowledge of the influence of education research on the development of efficient methods in teaching.
• To be familiarized with the latest achievements in educational physics and to be acquainted with the application of newer and different methods in active learning and teaching.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">• Physics Education I
• Physics Education II</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">• To be able to use professional literature and other relevant information sources in order to write lecture plans.
• To adapt old or to produce new teaching materials in order for it to be motivating for active learning of all pupils.
• To analyze the possibilities, demands and results of large scale testing.
• To apply basic experimental techniques and measured data processing.
• To define measurable learning outcomes of physics classes in accordance with curriculum.
• To apply knowledge in psychology, pedagogy, didactics and methods in teaching physics.
• To use ICT technologies in physics classes.
• To apply modern tools and methods for interactive physics teaching.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Lectures (L) – 30 hours:
1. Introduction lesson (introducing students and lecturers, description of work methods, student obligations and evaluations of achievements).
2. Implications of research in teaching physics (approaches, methodologies, qualitative and quantitative research).
3. Construction of tests and psychometric models.
4. Standardized instruments for evaluation of the level of adoption of physical concepts. 5. Implication of cognitive models in learning and teaching.
6. Cognitive levels of knowledge and taxonomy.
7. Basic principles of evaluation of pupil’s accomplishments in physics.
8. Program for International Student Assessment (PISA).
9. Trends in International Mathematics and Science Study (TIMSS).
10. Lifelong professional development of teachers.
11. Scientific and professional journals for physics teachers.
12. How to get and keep pupils interested in a teaching lesson.
13. Few efficient methods of teaching (flipped classroom, peer learning, models of the classroom).
14. Tools for interactive teaching in physics.
15. Student projects, working in groups, e-learning. Laboratory exercises (LE) – 30 hours: Students prepare experimental setup, run experiments, describe and explain results that will be done by them or their pupils in high schools. Seminar and praxis in high or higher school (S) – 30 hours: Observing cooperating teacher's lessons, writing lecture plans and giving trial lectures under supervision of cooperating teacher and university teacher.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☑ Laboratory
☑ Mentoring</td><td>☑ homework assignments
☐
☐
☐</td></tr>
</table>

<table>
<tr><td>Student obligations</td><td>Attendance of at least 80% of lectures and 80% of laboratory exercises. Observing 30 classes in high or higher school. Written lecture plans for two lessons and two trial lectures given in high or higher school.</td></tr>
<tr><td>Monitoring student work</td><td><table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td>1.5</td></tr>
<tr><td>Experimental work</td><td>1</td><td>Paper</td><td></td><td>Domaće zadaće</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td>• Class attendance and homework - up to 10 points
• Written lecture plans for high school - up to 14 points
• Two lectures given in a high school school- up to 16 points
• Notes from the class observations and seminar (analysis and self-analysis) up to 10 points
• Written exam - up to 10 points
• Oral exam - up to 20 points
• Laboratory exercises - up to 20 points
Written exam is consisted of problems (exercises) that are appropriate for high school physics level. Oral exam is consisted of 5 conceptual questions randomly selected from a pre-given list of questions. Each question is from a different teaching unit.
Final grade is given as follows:
• 89 - 100 points: excellent
• 76 - 88 points: very good
• 63 - 75 points: good
• 50 - 62 points: sufficient</td></tr>
<tr><td>Required literature</td><td><table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>E. F. Redish, Teaching Physics with the Physics Suite, John Wiley & Sons Inc. 2003.</td><td></td><td></td></tr>
<tr><td>E. Mazur, Peer Instruction: A User's Manual, Prentice Hall, 1997</td><td></td><td></td></tr>
<tr><td>Papers from current periodicals: Am. J. Phys, Phys. Teach, Phys. Educ, Int. J. of Sci. Educ.</td><td></td><td></td></tr>
<tr><td>Approved physics textbooks for high and higher school.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td>B. Arons, Teaching Introductory Physics, John Wiley & Sons Inc. 1996.
Paul G. Hewitt, Conceptual Physics, 12th Edition, Addison-Wesley, 2014.</td></tr>
<tr><td>Quality assurance</td><td>• Evaluation of student achievements in accordance with expected outcomes
• Lecturer's self-evaluation
• Student feedback through questionnaires
• In-institution and out-institution review</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td></td></tr>
</table>

Subject name	Chemistry Education I		
ID	PMC210	Study year	1.
Lecturer	dr. sc. Roko Vladušić, v. pred.	Points value (ECTS)	4.0
Associates		Class execution (number of hours in semester)	L: 30, S: 30, E: 0, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description

Subject goals	The aim of course is to provide opportunities for construction of theoretical and practical knowledge about teaching and learning chemistry. Also, students will be taught how to investigate and recognize the lawfulness of chemistry instruction.
Enrolment requirements	There are no prerequisites for enrolment in the course; starting competencies are related to the adequate knowledge of chemistry.
Learning outcomes	Students: – based on historical features of the development of chemistry and chemistry education, will be able to see the importance and necessity of the experimental approach to the chemistry teaching, – will be able to explain the position of Chemistry Education in the area of Science and Education, as well as the object of its research, – will be able to analyse the purposefulness and effectiveness of different approaches to teaching and learning chemistry in dependence of the content specifics, – will be able to safely and properly apply the theoretical knowledge in experiment's preparation and implementation in the chemistry instruction, – will be able to analyse students' knowledge regarding to the levels and types of knowledge and – will be able to explain and organise instruction related to the fundamental chemical laws, theories and concepts, as part of their Pedagogical content knowledge.
Syllabus	1. History of Chemistry and Chemistry Education (3 Lectures + 1 Seminar) 2. Presentation of selected content issues in Chemistry Education (1 L + 3 S) 3. The place of Chemistry education in science (4 L) 4. Explanations of fundamental chemical laws (4 S) 5. Sources of knowledge in chemistry instruction (6 L + 4 S) 6. Safety and protection in experimental work (2 L) 7. Strategies, methods and procedures in Chemistry instruction (4 L + 4 S) 8. Learning outcomes in Chemistry Instruction ((2 L + 4 S) 9. Pedagogical content knowledge (2 L + 6 S) 10. The role of taxonomy of knowledge in Chemical Education in evaluation processes (2 L + 4 S)
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	To attend laboratory exercises, to design and perform experiments, to develop worksheet for experiment implementation in classroom.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	0.5		
Colloquiums		Oral exam	1.5		
Written exam		Project			

Assessment and evaluation of student work	Individual assignments 20 %, Pre-exam, 20 %, Oral exam 60 %

Required literature

Title	Number of copies available	Availability on other medium
Sikirica, M. (2004). Metodika nastave kemije, Školska knjiga, Zagreb.		

	Mrklić, Ž. (1998). Metodika nastave kemije – sažeci predavanja, (interna skripta), Split.		
Supplementary literature	Chemistry textbooks approved by Ministry of Science, education and sport. Holyman, S. (2006). Teacher's book– GCSE Chemistry, Nelson Thornes Ltd, Cheltenham. Pienta, N. J., Cooper, M., M. and Thomas J. Greenbowe (2005). Chemists' guide to effective teaching, Pearson education, New Jersey. Bucat, B. and Fenshman, P. (1995). Selected papers in chemical education research, IUPAC.		
Quality assurance	Personal consultations, Individual tasks analysis, Internal evaluation of learning outcomes achievement; Institutional evaluation at the end of the semester.		
Other (in the opinion of the proponent)			

Subject name	Chemistry Education II		
ID	PMC212	Study year	2.
Lecturer	dr. sc. Roko Vladušić, v. pred.	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 30, E: 0, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description

Subject goals	The goal of the course is development of scientific type of thinking as foundation for heuristic chemistry instruction based on experiments, research and problem solving. The students' knowledge constructed during this course will enable quality preparation and implementation of teaching process.
Enrolment requirements	Chemistry Education I obligations completed (except exam); starting competencies are related to the adequate knowledge of Chemistry, Pedagogy, Didactic and Educational Psychology.
Learning outcomes	Students will be able to: – explain the criteria for selected teaching strategies related to the chemical content, – design and develop high-quality Chemistry lessons' preparation sheets, – apply appropriate teaching materials and techniques, – make a valid evaluation instruments, – define the levels of chemistry triplet and properly use them during teaching, – organize active learning of Chemistry, – correctly interpret the meaning of key concepts relevant to the curriculum, – explain the importance of proper language usage of in chemistry instruction, – prepare and perform chemistry lesson according to the quality teaching principles and – explain the concept of the Pedagogical (Chemistry) content knowledge and support it with examples.
Syllabus	1. Types of work in Chemistry instruction (2 Lectures + 2 Seminars/workshops) 2. Types of teaching lessons in Chemistry instruction (1 L) 3. The role of exercise in Chemistry instruction (2 L) 4. Teaching technique in Chemistry instruction (1 L) 5. Evaluation of knowledge (4 L) 6. The models and modelling in Chemistry (2 L) 7. Development of evaluation instruments (2 L + 2 S) 8. Micro-articulation of chemistry lesson (2 L + 4 S) 9. Chemistry curriculum (4 L) 10. Chemistry triplet (4 L) 11. Active learning in Chemistry instruction (2 L + 2 S) 12. The role and importance of language in chemistry instruction (2 L) 13. Design, organization and implementation of selected chemistry topics (2 L + 6 S) 14. Pedagogical content knowledge (II) - analysis of chemistry content knowledge and its translation into chemistry for teaching (14 S)
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	To attend classes, to accomplish individual tasks, to develop written preparation for teaching, to conduct a lesson.

Monitoring student work						
	Class attendance	2	Research		Practical work	
	Experimental work		Paper		Ispitni sat	1
	Essay		Seminar paper	0.5		
	Colloquiums		Oral exam	1.5		
	Written exam		Project			

Assessment and evaluation of student work	Seminar work 20 % Teaching lesson simulation 20 % Oral exam:60 %

Required literature		Number	

	Title	of copies available	Availability on other medium
	Sikirica, M. (2004). Metodika nastave kemije, Školska knjiga, Zagreb		
	Mrklić, Ž. (1998). Metodika nastave kemije – sažeci predavanja, (interna skripta), Split.		
Supplementary literature	Chemistry textbooks approved by Ministry of Science, education and sport. Holyman, S. (2006). Teacher's book– GCSE Chemistry, Nelson Thornes Ltd, Cheltenham. Pienta, N. J., Cooper, M., M. and Thomas J. Greenbowe(2005). Chemists' guide to effective teaching, Pearson education, New Jersey. Bucat, B. and Fenshman, P. (1995). Bucat, B. and Fenshman, P. (1995). Selected papers in chemical education research, IUPAC. Taber, K. (2002). Chemical misconceptions – prevention, diagnosis and cure, Volume 1: Theoretical background, London. Taber, K. (2002). Chemical misconceptions – prevention, diagnosis and cure, Volume 2: Classroom resources, London.		
Quality assurance	Personal consultations, Individual tasks analysis, Internal evaluation of learning outcomes achievement; Institutional evaluation at the end of the semester.		
Other (in the opinion of the proponent)			

Subject name	MMethods of Instructions in Applied Mathematics		
ID	PMM133	Study year	1.
Lecturer	prof. dr. sc. Damir Vukičević	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	5%

Subject description

Subject goals	The goal of this course is to enable students to successfully plan, organize, realize and evaluate courses in applied mathematics. Particularly, students will learn the basics of descriptive and inferential statistics, and financial mathematics, linar programming - this will cover many topics needed to teach financial mathematic and mathematical economy in secondary schools. Also, their understanding of the modern world filled with financial topics will be vastly improved. Moreover, students will be enabled to preform statistical research on various real-life topics.
Enrolment requirements	Prerequisites: introductory mathematical course completed. Required competencies: knowledge of elementary mathematics.
Learning outcomes	Student is able to: - explain basic statistical methods - apply basic statistical methods on solving simpler tasks - envision, develop, and lead simpler statistical research - discuss applicability of proposed statistical method in a given context - recommend statistical method for proposed research - calculate loan rates or accumulation of savings - compare and recommend the best methods of taking loans or saving -solve basic problems of linear programming
Syllabus	1st week: Introduction to descriptive statistics 2nd week: Population and variables - population parameters; 3rd week: Standardized variable. Chebyshev's theorem. 4th week: Discrete probability. 5th week: Continuous probability. 6th week: Random variable. 7th week: Correlation. 8th and 9th week: Elements of the inferential statistics. Interplay of probability and statistics. Sampling methods. Estimators. Sampling distributions. 10th week: Confidence intervals for mean, proportion, variance, difference of means and proportions. 11th week: Hypothesis testing, parametric tests, non-parametric tests. 12th week: Economic functions. Equilibrium. Elasticity. 13th and 14th week: Calculation of interest rates and loan rates. 15th week: Savings and rents. Basic methods of linear programming
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Lecture attendance.

Monitoring student work

Class attendance	1.5	Research		Practical work	
Experimental work		Paper		Ispit	3.5
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	

Required literature

Title	Number of copies available	Availability on other medium

	N. Koceić Bilan, Primijenjena statistika		
	N. Koceić Bilan, Nastavni materijal iz Osnova financijske matematike		
Supplementary literature	B. Šego, Z. Lukač Financijska matematikaA. Šegota: Financijska matematika, Udžbenici Sveučilišta u Rijeci 2012 Financijska matematika, ppt, Ekonomski fakultet Sveučilišta u Zagrebu		
Quality assurance	Statistics of exam results and student's course evaluation (survey according to rules of the University of Split).		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="7">Interaction Design Methodology</td></tr>
<tr><td>ID</td><td>PMIH40</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Andrina Granić</td><td>Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">25%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Acquisition of fundamental knowledge related to the interdisciplinary field of Interaction Design (ID) defined as the design of interactive products to support people in their everyday and working lives, including psychological and social aspects of users, interaction styles, user requirements, up-to-date design approaches, usability and evaluation, traditional and future interface paradigms.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">No formal prerequisites, but it would be preferable if students have already acquired basic knowledge from the course Human-Computer Interaction I: Fundamental Principles.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. Name and explain fundamental terminology and concepts from the Interaction Design (ID) field.
2. Decide on and critically evaluate selection of adequate methods for the design of user-centred interactive products (different phases of information collection, planning, prototyping and evaluation).
3. Critically evaluate positive and negative aspects of different design methods from the HCI field to be used in interactive product development.
4. Compare and decide on adequate methodology for interactive product evaluation.
5. Argue on the role of available HCI methods in system development.
6. Use case: critically evaluate reasons for the development of interactive system /product; identify context of use and collect all relevant information in relation to the goal; produce personas, scenarios of use and low fidelity prototypes; apply adequate user-centred design methods; produce high fidelity prototypes; decide on and employ adequate evaluation approach.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Lectures:
1. Interaction Design (ID): definitions and fundamental principles (2h)
2. Short chronology on interaction design (2h)
3. Usability, user experience, quality in use (2h)
4. Designing for user experience (2h)
5. Research methods: visualization of information, interfaces and interactions (2h)
6. Invited lecture (2h)
7. Interaction Design model: user-centred design, prototyping, evaluation, implementation4h)
8. Personas and scenarios (2h)
9. Sketching, low and high fidelity prototypes (2h)
10. Participatory design (2h)
11. Methods and approaches to interaction evaluation (4h)
12. The future of Interaction Design (4h)
Exercises:
1. Introduction to course exercises - generally about structure of exercises; gained knowledge and skills; topics which will be covered; work flow; individual and group tasks; grading.
2. Introduction to interaction design - digital artefacts design; new technologies; new interfaces; 1. individual task for students (analysis of 3 interaction design examples).
3. Presentations of the 1. individual student tasks - analysis and discussion.
4. Accessibility - design for all and universal accessibility; accessibility and usability; disability categories and examples of accessible interaction design; 2. individual task for students (analysis of interactive interfaces designed for disabilities categories).
5. Presentations of the 2. individual student tasks - analysis and discussion.
6. Understanding users - emotional aspects; emotional interfaces; persuasive technologies; anthropomorphism; virtual agents and characters; virtual learning assistants.
7. User experience design - 5 design levels; user needs; creation of the “personas”.
8. Introduction to group project - design, evaluation and implementation of interactive object interface; analysis of current examples.
9. Selection of the concept for interactive object - group work.
10. Making a prototype of the interactive object interface - group work.</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">11. Evaluation of the interactive object interface – group work.
12. Group presentations of conducted evaluation – analysis and discussion.
13. Defining necessary changes on interactive object interfaces – group work.
14. Implementation of necessary changes on interactive object interfaces – group work.
15. Group projects – final presentations of student projects</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☑ Laboratory
☑ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Active participation in all activities: lectures, consultations, searching the literature, individual work in the assigned project and given use case; final oral exam</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td>2</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Quality of performance of assigned tasks (50%).

Oral exam (50%).</td></tr>
<tr><td>Required literature</td><td colspan="3"><table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>J. Preece, Y. Rogers, H. Sharp: Interaction Design: Beyond Human-Computer Interaction, John Wiley & Sons, 4th Edition, 2015.</td><td></td><td></td></tr>
<tr><td>D. Saffer: Designing for Interaction, Second Edition: Creating Innovative Applications and Devices, New Riders, 2010.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">1. D. Norman: Emotional Design: Why We Love (or Hate) Everyday Things, Basic Books, 2005.
2. B. Shneiderman: Human Needs and the New Computing Technologies, MIT Press, 2003.
Svi nastavni materijali dostupni on-line, uključujući i dodatnu znanstvenu literaturu</td></tr>
<tr><td>Quality assurance</td><td colspan="3">student discussion, anonymous student evaluation questionnaire, student success rate, self-assessment</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Research Methodology in Education</td></tr>
<tr><td>ID</td><td>PMS114</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Anna Alajbeg</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 15
E: 0
P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">To understand and master the techniques of scientific research.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">No</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. A qualification for scientific thinking and research of pedagogical phenomena,</td></tr>
<tr><td>Syllabus</td><td colspan="3">1.The cognition and epistemological assumptions of science 2. The structure, system and classification of science 3. Science and research – approaches, aspects and types of research 4. Technology of scientific research work – projects 5. Methods 6.Experiment 7. Procedures, instruments and techniques of data collection 8 ./9. Measuring characteristics of instruments 10. The work on documentation 11. Systematic observation and interviewing 12. Interviewing 13. Assessing and deliberation14. Testing and examination with objective tasks 15. Research report</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Class attendance, preparation and presentation of the seminar paper, preliminary exams or oral exam (if student wants).</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>1</td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Class attendance and activity, the results of preliminary exams or written exam results or results of oral exam (if student wants).</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Vujević, M. (2001.): Uvođenje u znanstveni rad u području društvenih znanosti. Školska knjiga, Zagreb.</td><td></td><td></td></tr>
<tr><td>Mužić, V. (2002.): Uvod u metodologiju istraživanja odgoja i obrazovanja. Educa, Zagreb.</td><td></td><td></td></tr>
<tr><td>Mužić, V. (1982. i dalje): Metodologija pedagoških istraživanja. Svjetlost, Sarajevo. (izabrana poglavlja)</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">1. Halmi, A. (2001.): Metododoligija istraživanja u socijalnom radu. Alinea, Zagreb. 2. Halmi, A. (1996.): Kvalitativna metododoligija u društvenim istraživanjima. AGM, Samobor.
3. Halmi, A. (2003.): Strategije kvalitativnih istraživanja u primjenenim društvenim znanostima. Naklada Slap, Jastrebarsko.
4. Periodika: Napredak, Odgojne znanosti, Društvena istraživanja...**</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Consultations, discussion, active participation, evaluation.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3">* Contents are listed for academic block-hours (15 terms x 2 hours)
**Seminar papers are presented in seminar groups (15x1 per group) and represent an conceptual-technical research project.</td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Metodologija istraživanja u obrazovanju</td></tr>
<tr><td>ID</td><td>PMS114</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Anna Alajbeg</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15
S: 15
E: 0
P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3"></td></tr>
<tr><td>Enrolment requirements</td><td colspan="3"></td></tr>
<tr><td>Learning outcomes</td><td colspan="3"></td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3"></td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3"></td></tr>
<tr><td>Required literature</td><td colspan="3"><table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="3">–</td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Research Methodology in Natural Sciences					
ID	PMP104	Study year	1.			
Lecturer	izv. prof. dr. sc. Damir Kovačić	Points value (ECTS)	4.0			
Associates		Class execution (number of hours in semester)	L	S	E	P
			30	0	15	0
Subject status	Compulsory	Online percentage	20%			

Subject description

Subject goals	To familiarize students with research methods in the field of natural sciences.
Enrolment requirements	Enrolled one of the diploma study programs.
Learning outcomes	1. To distinguish between scientific and non-scientific approach to problem solving. 2. To enumerate basic methods of research in the natural sciences. 3. To define steps in setting up scientific research in the natural sciences. 4. To analyze scientific paper. 5. To create structure of the scientific article. 6. To define the methods of scientific communication.
Syllabus	1. Basic scientific methods and principles. 2. Testability of scientific hypotheses. 3. The differences in the methods and aims of the work with social, technical and natural sciences. 4. Reproducibility, standards, controls, and displays of measurement errors. Iterative cycles of experiments and hypotheses. 5. Science as global process. 6. How to recognize scientific work. The choice of research problem - to be both conservative and revolutionary. 7. How to solve a scientific problem. How to describe the results. 8. How to relieve colleagues that we find the errors. The key role of better communication with colleagues. 9. Impact factor journals. Quotes papers - examples. How to cite references. 10. Science on the Internet - what are the servers. 11. Science in Croatia. 12. Examples of good and bad works. 13. Term papers from this course. 14. The principles of work during graduate / master's and doctoral thesis. 15. Evaluation work.
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	The student is required to attend lectures, seminars and exercises, with a maximum of 20% of excused absences. The student is required to write a term paper with the chosen topic and present it in the form of presentation to colleagues and teacher.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	2		
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	The grade is determined based on: - Seminar paper (50% grade) - Oral presentation (50% grade)

Required literature

Title	Number of copies available	Availability on other medium
R. N. Giere: Understanding Scientific Reasoning, Thomson-Wadsworth, SAD, 1997. ISBN 0-15-501625-3.		

Supplementary literature	[1] P. D. Leedy I J. E. Ormrod: Practical Research. Planning and Design. Pretince

	Hall, SAD. 2001. ISBN 0-13-121854-9. [2] R. N. Giere: Understanding Scientific Reasoning, Thomson-Wadsworth, SAD, 1997. ISBN 0-15-501625-3.
Quality assurance	Evaluation of results in accordance with the determined learning outcomes. Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split. Self-evaluation of teacher. Institutional and non-institutional checks.
Other (in the opinion of the proponent)	

Subject name	Metric spaces					
ID	PMM601	Study year	1.			
Lecturer	doc. dr. sc. Goran Erceg	Points value (ECTS)	6.0			
Associates		Class execution (number of hours in semester)	L	S	E	P
			45	0	0	0
Subject status	Compulsory	Online percentage	30%			

Subject description	
Subject goals	The course objective is to introduce students with advanced knowledge of metric spaces applying already known topological concepts and results about topological spaces. A special emphasis is on studying complete metric spaces, function spaces and Banach algebra of continuous real functions on compact space. This gives the basics for more advanced studies in modern functional and numerical analysis.
Enrolment requirements	Successfully completed course: Introduction to topology
Learning outcomes	It is expected that student will – understand special properties of basic topological concepts (convergence, continuity, compactness) in metric spaces – understand metric concepts (boundedness, total boundedness, Cauchy sequences, completeness, uniform continuity) and their dependence on metric. – be able to state and prove standard results regarding (compact, complete) metric spaces and (uniformly) continuous functions – be able to apply the theory in the course to reason about concrete metric spaces and their properties – be able to decide whether a simple statement about metric spaces and continuous functions is true, providing a proof or counterexample as appropriate – develop critical and analytical thinking and demonstrate skills in communicating mathematics orally and in writing
Syllabus	– Metric spaces (6 hours) Bounded and totally bounded sets in metric space. Metric topology. Metrizability. Metrizability of product space. – Convergence and continuity (6 hours) Cauchy and convergent sequences in metric space. Continuous functions between metric spaces. Perfectly normal spaces. Theorem of Vedenisoff. Uniformly continuous functions. Heine-Cantor theorem. Topologically equivalent metrics. Uniformly equivalent metrics. Lipschitz equivalent metrics. – Function spaces (10 hours) Pointwise, uniform, and compact convergence. Pointwise convergence topology. Uniform topology. Compact convergence topology. Compact-open topology. – Completeness (11 hours) Complete metric spaces. Cantor theorem. Completeness and operations on metric spaces. Banach fixed point theorem. Baire theorem. Uniform boundedness principle. Completion of metric space. Kuratowski embedding theorem. Uniqueness of completion. – Banach algebra of continuous real functions on compact space (6 hours) Arzela-Ascoli theorem. Stone-Weierstrass approximation theorem – Metrization theorems (6 hours) Urysohn metrization theorem. Nagata-Smirnov metrization theorem. Local metrizability.

Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐
Student obligations	Attendance at lectures, seminars and exercises, written assignments, self-study using required and optional literature		

Monitoring student work	Class attendance	1.5	Research		Practical work	
	Experimental work		Paper	0	Ispit	4.5
	Essay		Seminar paper			
	Colloquiums		Oral exam			

	Written exam		Project			
Assessment and evaluation of student work	IThe exam consists of written and oral part. The oral part comes after positively graded (at least 50%) written part Both parts of the exam are equally evaluated in the final grade					
Required literature	Title	Number of copies available	Availability on other medium			
	J. Munkres, Topology, Pearson Education International, New York, 2000		da			
	S. Shirali, H. Vasudeva, Metric spaces, Springer-Verlag, London 2006.		da			
	S. Mardešić, Matematička analiza u n-dimenzionalnom realnom prostoru I, Školska knjiga, Zagreb, 1974.					
Supplementary literature	J. Dugundji, Topology, Allyn and Bacon Inc., Boston, 1966. R. Engelking, General Topology, PNW, Warszawa, 1977					
Quality assurance	Exam statistics and students' quality evaluation through anonymous poles					
Other (in the opinion of the proponent)						

<table>
<tr><td>Subject name</td><td colspan="6">Mikroorganizmi oko nas</td></tr>
<tr><td>ID</td><td>PMB413</td><td>Study year</td><td colspan="4">3.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Ana Maravić</td><td>Points value (ECTS)</td><td colspan="4">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>15</td><td>0</td><td>15</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">10%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Upoznati studente sa ulogom i raznolikosti mikrobnih zajednica koje nas okružuju, prezentirati im najnovije znanstvene činjenice, s posebnim osvrtom na patogene i potencijalno patogene mikroorganizme u našoj neposrednoj okolini, kao i omogućiti im direktnu primjenu standardnih laboratorijskih postupaka i tehnika koje se koriste u izolaciji mikroorganizama iz različitih uzoraka te njihovoj identifikaciji.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Odslušan predmet Osnove mikrobiologije</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Student će nakon položenog ispita moći:
1.tumačiti znanje o ekologiji i biološkoj raznolikosti mikrobnih zajednica u različitim staništima;
2.primijeniti metode i tehnike rasta te izolacije i identifikacije različitih vrsta mikroorganizama;
3.primijeniti stečena znanja u planiranju i provođenju istraživanja u mikrobiološkom laboratoriju;
4.analizirati rezultate mikrobioloških ispitivanja uzoraka različitog porijekla;
5.donositi zaključke o rezultatima eksperimenata koji uključuju istraživanje
6.zajednica bakterija i gljivica u ljudskoj okolini;
7.prepoznati rizike za ljudsko zdravlje i opravdati nužnost provedbe mjera higijene i sanitacije</td></tr>
<tr><td>Syllabus</td><td colspan="6">Predavanja:
1.Uvodno predavanje - upoznavanje sadržaja predmeta, literature i obveza studenata. Sanitarna mikrobiologija kao posebna mikrobiološka disciplina. (2 sata)
2.Čimbenici rasta mikroorganizama i mikrobna ekologija. (2 sata)
3.Mikroorganizmi oko nas: ljudsko tijelo. (2 sata)
4.Mikroorganizmi u vodi-indikatorski mikroorganizmi, standardi za procjenu kakvoće različitih tipova voda (pitka voda, rijeke, more i sl.), izvori onečišćenja i rizik za ljudsko zdravlje (3 sata)
5.Mikroorganizmi u tlu - struktura mikrobnih zajednica tla (3 sata)
6.Mikroorganizmi u hrani: osnovna obilježja, izvori i bolesti koje se prenose kontaminiranom hranom (3 sata)

Laboratorijske vježbe:

1.Priprema hranjivih podloga i materijala. (3 sata)
2.Brisevi i određivanje higijene radnih površina, ruku i zraka (3 sata)
3.Određivanje ukupnog broja heterotrofnih bakterija (CFU-standard plate count) te indikatora fekalnog onečišćenja (Escherichia coli i fekalnih enterokoka) u različitim uzorcima vode - pitka voda, rijeka i more. (3 sata)
4.Određivanje ukupnog broja heterotrofnih bakterija (CFU) u tlu. Biokemijska identifikacija najvažnijih skupina mikroorganizama. (3 sata)
5.Određivanje mikrobiološke ispravnosti hrane. Određivanje ukupnog broja heterotrofnih bakterija (CFU) u mesu.
Izolacija i identifikacija Gram-pozitivnih patogenih bakterija u hrani (Staphylococcus spp. Enterococcus spp., Listeria monocytogenes) te sporogenih bakterija (Clostridium perfringens i C. botulinum).
6.Izolacija i biokemijska identifikacija različitih vrsta Enterobacteriaceae - Enterobacter spp., Klebsiella spp., Salmonella spp., Escherichia coli (3 sata)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☑ Laboratory
☐ Mentoring</td><td colspan="3">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Nazočnost na predavanjima u iznosu od najmanje 70% predviđene satnice. Obavljene</td></tr>
</table>

	sve predviđene laboratorijske vježbe.					
Monitoring student work	Class attendance	1	Research		Practical work	
	Experimental work	0.5	Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam	0.5		
	Written exam		Project			
Assessment and evaluation of student work	Konačna ocjena studenta će se bazirati na temelju aktivnosti na laboratorijskim vježbama i ostvarenog uspjeha na usmenom ispitu.					

Required literature	Title	Number of copies available	Availability on other medium
	Kalenić, S., Mlinarić-Missoni, E. i suradnici. 2005. Medicinska bakteriologija i mikologija, Merkur A.B.D., Zagreb		
	Duraković, L., Duraković, S. Priručnik za rad u mikrobiološkom laboratoriju 1 : I. dio, knjiga prva, 1997.		
	Duraković, L., Duraković, S.Priručnik za rad u mikrobiološkom laboratoriju: I. dio, knjiga druga,1997. Durieux, Zagreb		
	Krstulović, N., M. Šolić, 2006. Mikrobiologija mora, IOR-Split, Udžbenik Sveučilišta u Splitu.		
	Duraković S., Delaš F., Stilinović B., Duraković L.: Moderna mikrobiologija namirnica - knjiga prva. Sveučilišni udžbenik (ured. S. Duraković). Kugler d.o.o., Zagreb, 2002.		
	Duraković S., Delaš F., Duraković L.: Moderna mikrobiologija namirnica - knjiga druga. Sveučilišni udžbenik (ured. S. Duraković). Kugler d.o.o., Zagreb, 2002		

Supplementary literature	Relevantni znanstveni članci
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Modelling Electromagnetic Phenomena in the Environment</td></tr>
<tr><td>ID</td><td>PMP26E</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Žarko Kovač
prof. dr. sc. Dragan Poljak</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 20
E: 10
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">– to enable students to understand and apply the basic principles of numerical modelling of radiation transmission in the environment
– setting and solving simple problems in environmental physics by application of modern numerical methods
– permanent acquisition and deepening of knowledge in the field of numerical modelling</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">– Mathematical Methods of Physics 3
– Electrodynamics I
– Electrodynamics II
– Ocean Physics I
– Meteorology I
– programing</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">– understanding and application of basic principles of numerical modelling of electromagnetic phenomena in environmental physics
– setting up and solving simple problems of radiation transmission in environmental physics
– acquiring basic knowledge about solar radiation
– a mathematical description of the propagation of light through the atmosphere and the sea
– knowledge of modelling the greenhouse effect
– acquiring introductory knowledge about the interaction of light and the biosphere</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Introduction to numerical modelling and classification of numerical methods, and analysis in frequency and time range (2 hours of lectures)
2. Finite difference method (4 hours of lectures and 2 hours of exercises)
3. Finite element method (4 hours of lectures and 2 hours of exercises)
4. Final volume method (4 hours of lectures and 2 hours of exercises)
5. Application of numerical methods to classical electrodynamics and thermodynamics (2 hours of lectures and 4 hours of exercises)
6. Defining the topic of the seminar paper (10 hours of the seminar)
7. Introduction to the theory of radiation transfer (2 hours of lectures)
8. Black body radiation and solar radiation (2 hours of lectures)
9. Atmospheric optics (2 hours of lectures)
10. Ocean optics (2 hours of lectures)
11. Long-wave radiation and the greenhouse effect (2 hours of lectures)
12. Remote sensing (2 hours of lectures)
13. Interaction of light and the biosphere (2 hours of lectures)
14. Presentation of seminar paper (10 hours of seminar)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☑ Mentoring</td><td>☑ domaće zadaće
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attend at least 70% of lectures and 70% of exercises.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Domaće zadaće</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">During the first 7 weeks of classes, students receive 5 homework assignments from the first 6 teaching units. These assignments are handed over at the end of the 8th</td></tr>
</table>

	week of classes. During the next 7 weeks of classes, students receive 5 new homework assignments from the next 5 teaching units. These assignments are handed over at the end of the 15th week of class. Students who submit assignments on time and achieve more than 50% of the possible points are exempted from writing the written part of the exam. Students who do not pass assignments or achieve less than 50% of the possible points must take a written exam. In the first 7 weeks of classes, the teacher gives lectures on possible seminar topics. In the 8th week of classes, students choose the topic of the seminar to be submitted by the end of the semester. Students present the seminar at the end of the semester and submit a written version of the seminar before the exam deadline. The final grade is formed on the basis of homework / exams (1/3 grade), seminars (1/3 grade) and answers to the oral exam (1/3 grade).

Required literature	Title	Number of copies available	Availability on other medium
	Howard R. Gordon Physical principles of ocean color remote sensing International ocean color coordinating group, 2019.		

Supplementary literature	Muhammad Iqbal An Introduction to solar radiation Elsevier, 1983. John T. O. Kirk Light and photosynthesis in aquatic ecosystems Cambridge Universiy Press, 2011. Dragan Poljak Teorija elektromagnetskih polja s primjenama u inženjerstvu Skolska knjiga, 2014.
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Environmental Fluid Dynamics</td></tr>
<tr><td>ID</td><td>PMP26D</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Žarko Kovač</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 20
E: 10
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">– provide knowledge of differential equations describing fluids in the environment
– provide knowledge on methods of temporal integration and spatial discretization of partial differential equations
– gain knowledge about analytical solutions of advection and diffusion equations and their application to fluids in the environment
– get acquainted with numerical methods for solving advection and diffusion equations
– acquire introductory knowledge about turbulence
– get acquainted with the models of advection, diffusion and reaction
– acquire basic knowledge on modelling biological and chemical interactions that take place in the environment</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">– Introduction to Fluid Mechanics
– Meteorology I
– Ocean Physics I
– Meteorology II
– Ocean Physics II</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">– understanding the basic dynamics of fluids in the environment
– knowledge of the application of methods of temporal integration and spatial discretization of partial differential equations
– knowledge of elementary analytical solutions of advection and diffusion equations
– knowledge of solving advection and diffusion equations by numerical methods
– application of analytical and numerical methods for solving differential equations which describe fluids in the environment
– knowledge of implementing numerical methods via computers
– basic knowledge of biological and chemical interactions that take place in the environment and how to model them</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Finite differences (2 hours of lectures and 2 hours of seminars)
2. Methods of time integration (4 hours of lectures and 2 hours of exercises)
3. Methods of spatial discretization (2 hours of lectures)
4. Advection equation: analytical approach (2 hours of lectures and 1 hour of exercises) 5. Advection equation: numerical approach (2 hours of lectures and 2 hours of exercises) 6. Defining the subject of the seminar paper (10 hours of the seminar)
7. Diffusion equation: analytical approach (2 hours of lectures and 1 hour of exercises)
8. Diffusion equation: numerical approach (2 hours of lectures and 2 hours of exercises) 9. Advection-diffusion equation (2 hours of lectures and 2 hours of exercises)
10. Reynolds averaging (2 hours of lectures)
11. Turbulent advection-diffusion equation (4 hours of lectures)
12. Physical, chemical and biological transformations (4 hours of lectures)
13. Turbulent advection-diffusion-reaction equation (2 hours of lectures)
14. Presentation of the seminar paper (10 hours of seminar)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☑ Mentoring</td><td>☑ domaće zadaće
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attend at least 70% of lectures and 70% of exercises.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Domaće zadaće</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
</table></td></tr>
</table>

	Written exam	1	Project				

Assessment and evaluation of student work	During the first 7 weeks of classes, students receive 5 homework assignments from the first 6 teaching units. These assignments are handed over at the end of the 8th week of classes. During the next 7 weeks of classes, students receive 5 new homework assignments from the last 7 teaching units. These assignments are handed over at the end of the 15th week of class. Students who submit assignments on time and achieve more than 50% of the possible points are exempted from writing the written part of the exam. Students who do not pass assignments or achieve less than 50% of the possible points must take a written exam. In the first 7 weeks of classes, the teacher gives lectures on possible seminar topics. In the 8th week of classes, students choose the topic of the seminar to be submitted by the end of the semester. In the seminar, they analyse the analytical model, discretize the model, and compare analytical and numerical results. Students present the seminar at the end of the semester and submit a written version of the seminar before the exam deadline. The final grade is formed on the basis of homework / exam (1/3 grade), seminar (1/3 grade) and the oral exam (1/3 grade).

	Title	Number of copies available	Availability on other medium
Required literature	Benoit Cushman-Roisin & Jean-Marie Beckers Introduction to Geophysical Fluid Dynamics: Physical and Numerical Aspects Academic Press, 2007.		da
	James C. McWilliams Fundamentals of geophysical fluid dynamics Cambridge university press, 2006.		da

Supplementary literature	Stanley J. Farlow Partial Differential Equations for Scientists and Engineers Dover Publications, 1993. Stanislaw R. Massel Fluid Mechanics for Marine Ecologists Springer, 1999. Benoit Cushman-Roisin Environmental fluid dynamics URL: http://www.dartmouth.edu/~cushman/books/EFM-old.html Scott A. Socolofsky & Gerhard H. Jirka Environmental fluid dynamics URL: https://ceprofs.civil.tamu.edu/ssocolofsky/OCEN677/book.html
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Modelling and Simulations of Biomacromolecule		
ID	PMP249	Study year	2.
Lecturer	doc. dr. sc. Željka Sanader Maršić	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description	
Subject goals	Understanding of the basics of the molecular dynamics and quantum chemical simulations and their application to biologically important systems.
Enrolment requirements	Basic knowledge of physics, biology, statistical mechanics, thermodynamics, classical and quantum mechanics, basics of programming
Learning outcomes	On completion of this course a student should be able to: 1. Recognize and discuss scientific ideas in modeling of reality and the importance of modeling in biology and medicine. 2. Understand the theoretical foundations of molecular dynamics methods and quantum-mechanical modeling methods. 3. Know the algorithms and techniques used in modeling biological molecular systems. 4. Independently model, simulate and analyze simple and some of the more complex systems of biomacromolecules by the method of molecular dynamics. 5. Understand the difference between molecular mechanical and quantum mechanical methods 6. Use the density functional theory to determine the most energetically favorable structure and its vibrational and absorption spectra. 7. Model the enzyme using a hybrid quantum mechanical / molecular mechanical method 8. Use visualization programs and show different ways of visualizing proteins
Syllabus	Weekly curriculum: INTRODUCTION 1. Course presentation; Methods of modeling biomolecules - basic characteristics and essential differences between empirical and quantum mechanical methods; Using the Linux operating system on computer clusters, basic commands, running / monitoring calculations on a computer cluster; 2. Database of three-dimensional structures of macromolecules "Protein Data Bank" (PDB); 3D structure prediction programs; Selected software tools for biomolecule visualization; Gromacs and Gaussian software packages; BASICS OF MD SIMULATIONS 3. Fundamentals of molecular dynamics (MD) method, equations of motion, numerical integrators, thermodynamic and statistical-mechanical basis of MD method, initial conditions in simulations of biological systems; 4. Force fields (classical atomic force fields, coarse-grained models ...), Solvent models; Simulation; Calculation of statical and dynamical quantities in MD; MD SIMULATIONS 5. MD simulation of proteins in water; Structural quantity analysis; Visualization of biological systems; 6. MD simulations of complex systems (e.g.: protein and ligand, membrane proteins, protein clustering); 7. Advanced sampling methods: "Umbrella sampling"; BASICS OF QM SIMULATIONS 8. Fundamentals of quantum mechanical (QM) method; Introduction to the theory of density functionals (approximations, Hohenberg - Kohn theorems, self-consistent field ...); 9. Functionals, basis sets; Limitations of the method; QM SIMULATIONS 10. QM simulations of peptides (geometry optimization, vibrational spectra, absorption spectra); 11. QM cluster method; QM/MM SIMULATIONS 12. Hybrid quantum-mechanical / molecular-mechanical methods (QM/MM): "additive and subtractive" approach; Mechanical and electrical embedding; Treating the boundary of the QM and MM parts of the system 13. Modelling of the enzymes using QM/MM method; ELECTIVE TOPICS 14. and 15. Elective topics of interest to students: nonequilibrium MD, simulations in confined spaces, optical properties of organic dyes, making simulation films

Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online		☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring		☑ homework assignment ☐ ☐ ☐	
Student obligations	Active participation in classes and assignments in class, solving of assignments at home, preparation of seminars that include independent solving of a physical problem, writing reports and presentations of the same.					
Monitoring student work	Class attendance	2	Research		Practical work	1
	Experimental work		Paper		Homework assignments	1
	Essay		Seminar paper	1		
	Colloquiums		Oral exam			
	Written exam		Project			
Assessment and evaluation of student work	The conditions for passing the exam are: the ability to use existing programs for modelling biomacromolecules. Assessment through computer assisted exercises and seminars. The grade is concluded according to the evaluation of the student's commitment in class and the grade of the seminar.					
Required literature	Title				Number of copies available	Availability on other medium
	Essentials of Computational Chemistry: Theories and Models, Christopher J. Cramer, John Wiley & Sons Ltd, England, 2004					yes
	Molecular Simulations: Fundamentals and Practice, Saman Alavi, Wiley-VCH Verlag GmbH & Co., Germany, 2020					yes
	Understanding Molecular Simulation: From Algorithms to Applications Daan Frenkel and B. Smit, Academic Press, 2001					yes
Supplementary literature	[1] P. Allen & D. Tildesley, Computer Simulation of Liquids, Clarendon, Press, Oxford, 1987. [2] Scientific articles, lectures.					
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split					
Other (in the opinion of the proponent)						

<table>
<tr><td>Subject name</td><td colspan="6">Modern Physics</td></tr>
<tr><td>ID</td><td>PMP008</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Željana Bonačić Lošić</td><td>Points value (ECTS)</td><td colspan="4">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>45</td><td>15</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Understanding of the basic concepts of modern physics and ability to explain them to others.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Passed exams in General Physics I, General Physics II, Mathematics I and Mathematics II</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. Explain the difference between the wave and photonic nature of electromagnetic radiation and apply the photon model to the corresponding phenomena (Planck's model thermal radiation, photoelectric effect, Compton effect).
2. Explain the Rutherford model of the atom, explain the quantization of energy in the atom on the example of Bohr's model of the hydrogen atom and explain the operation of the laser and the origin characteristic X-ray spectrum of atoms.
3. Define de Broglie's postulates and uncertainty principles and describe the experiments that confirmed the wave nature of matter.
4. Explain the properties of the Schrodinger equation, analyze quantum-mechanical model of hydrogen atom and spin of electron and explain filling of electron states in multi-electron atoms.
5. Explain the bonding of atoms in covalent and ionic molecules and crystals and analyze electronic, vibrational and rotational spectra of polyatomic molecules.
6. Analyze the difference between metals, semiconductors and insulators using a model of electron bands in solids and explain current conduction in metals and semiconductors.
7. Explain the structure and models of atomic nuclei, explain radioactivity and types of radioactive decay.
8. Describe the spectral types of stars and explain the formation of stars, describe nuclear processes in stars, apply Planck's blackbody model to star radiation.
9. Explain the division of basic forces and the classification of elementary particles, explain basic concepts of cosmology.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Rutherford scattering and Rutherford model of atom (6h).
Planck law of black body radiation (6h).
Bohr’s model of hydrogen atom (3h).
Franck-Hertz experiment (1h).
Photoelectric effect (3h).
Compton scattering (3h).
De Broglie hypothesis (3h).
Davisson-Germerov experiment (1h).
Bohr’s principle of complementarity and Heisenberg principle of uncertainty (2h).
Schrödinger wave equation (6h).
Tunnel effect (2h).
Harmonic oscillator (2h).
Hydrogen atom (3h).
Applications of quantum mechanics (6h).
Stern Gerlach experiment (4h).
Spin (1h).
Spectrum of X rays (3h).
Quantum structure of atoms, molecules and solids (8h).
Atomic nucleus (3h).
Radioactivity and types of radiactive decays (6h).
Models of atomic nuclei (3h).
Fission (1h).
Nuclear reactors (1h).
Fusion (1h).
Elementary particles (3h).
Basic forces and their mediators (3h).
Expansion of the universe (2h).</td></tr>
</table>

	Background radiation (2h). Big bang and the origin of the universe (2h).
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☑ Lectures accompanied with experiments. Seminar. Solving problems instructed by assistant. Uninfluenced solving of problems. Check of the solved problems and discussion on tutorials. ☐ ☐ ☐
Student obligations	Active lectures, seminars and exercises attendance.

Monitoring student work						
	Class attendance	3	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	1		
	Colloquiums		Oral exam	1		
	Written exam	1	Project			

Assessment and evaluation of student work	Preliminary exams. Written exam. Seminar. Oral exams which include all or partially teaching material.

Required literature	Title	Number of copies available	Availability on other medium
	1. R. A. Serway, C.J. Moses and C. A. Moyer, Modern Physics, Thomson, Brook/Cole, 2005.	2	on-line
	2. P. Županović and Ž. Bonačić Lošić: Predavanja iz Moderne fizike, skripta za internu uporabu		E-learning

Supplementary literature	D. Halliday, R. Resnick and J.Walker, Fundamentals of Physics. John Wiley, New York 2001
Quality assurance	Student's opinion poll.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Molekularna genetika</td></tr>
<tr><td>ID</td><td>PMB545</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Ivica Šamanić</td><td>Points value (ECTS)</td><td>3.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td><table><tr><td>L</td><td>S</td><td>E</td><td>P</td></tr><tr><td>30</td><td>15</td><td>0</td><td>0</td></tr></table></td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Kolegij obuhvaća temeljne pojmove molekularne genetike uključujući strukturu gena, transkripciju, translaciju, regulaciju genske ekspresije i replikacije. Kako je genomika temeljni sadržaj prikazat će se pregled najnovije metodologije korištene za genomske analize. Obradit će se prokariotski i eukariotski sustavi kroz povijesni i metodološki pristup za razumijevanje otkrića dobivenih eksperimentalnim radom. Time bi se sistematično prikazala i pojasnila složenost genetske strukture na razini od bakterijskih virusa do eukariotskih kromosoma.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Poznavanje osnova genetike i molekularne biologije.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Nakon uspješnog završetka kolegija studenti će moći:

objasniti što su geni i kako funkcioniraju, razjasniti mehanizme prijenosa informacija, od gena do proteina i kako su ti procesi regulirani
objasniti proces replikacije molekule DNA u bakterijama, plazmidima, pokretnim genetičkim elementima, kao i eukariotskim staničnim organelima i jezgri
razumjeti molekularne mehanizme povezane s ekspresijom gena na transkripcijskoj razini, s naglaskom na eukariote
izdvojiti informacije iz genskih baza podataka i vršiti analize DNA sekvenci pomoću mrežnih bioinformatičkih alata
usmeno prezentirati znanstvene činjenice
kritički razmotriti znanstvene članke iz molekularne genetike</td></tr>
<tr><td>Syllabus</td><td colspan="3">POPIS PREDAVANJA (30 sati)

1. Struktura i organizacija genoma; veličina genoma, introni i egzoni, struktura genoma virusa i prokariota organizacija genoma staničnih organela, organizacija nuklearne DNA u eukariota
2. Replikacija genoma
3. Model operona - regulacija ekspresije gena u prokariota
4. Transkripcijska i post-transkripcijska regulacija genske ekspresije u eukariota
5. Funkcionalna raznolikost RNA; kratke nekodirajuće RNA (snRNA, snoRNA, scaRNA, tRNA, miRNA, piRNA, siRNA),duge nekodirajuće RNA (jezgrine lncRNA, citoplazmatske lncRNA)
6. Funkcionalna genomika; ekspresija gena na biokemijskoj, staničnoj i razini organizma, genetika unaprijed (engl. forward genetics) i genetika unazad (engl. reverse genetics)
7. Translacija i post-translacijske modifikacije
8. Plazmidi; F plazmid i konjugacija, Ti plazmid i transformacija biljaka
9. Pokretni genetički elementi; transpozoni i retrotranspozoni
10. Komparativna genomika; dupliciranje gena, pseudogeni i retrogeni, molekularna filogenija, ortologni i paralogni geni
11. Metode sekvenciranja sljedeće generacije; priprema i umnožavanje biblioteke DNA za masivno paralelno sekvenciranje, platforme za sekvenciranje sljedeće generacije
12 Mutacije i popravak DNA
13. Biološka uloga mjesno-specifične rekombinacije; insercija (integracija λ bakteriofaga), delecija i inverzija segmenta DNA
14. Metode unošenja genskih mutacija u eukariotske stanice; transfekcija liposomima, prepravljanje genoma homolognom rekombinacijom, prepravljanje genoma pomoću mjesno-specifičnih endonukleaza (TALEN, nukleaze cinkovog prsta), protusmislene DNA/RNA
15. Terapijsko prekrajanje genoma - genetski postupci liječenja bolesti; genska terapija i RNA terapeutici, liječenje zamjenom mitohondrija

SEMINAR (15 sati)</td></tr>
</table>

	Studenti sami obrađuju originalni znanstveni rad iz polja genomike te javno prezentiraju svoj rad (uključuje prezentaciju u Power Point programu te diskusiju). Potrebno je dodatno pretraživanje literature iz izvora koje udžbenik ne pokriva dovoljno detaljno, s obzirom na područje molekularne genetike i genomike koje se brzo mijenja akumuliranjem novih znanstvenih podataka. Cilj je osposobiti studenta da jasno formulira te kratko i koncizno prezentira znanstvenu problematiku (15 minuta), integrira znanje stečeno tijekom trajanja kolegija kroz kritičko razmišljanje i zaključivanje tijekom diskusije na temu seminarskog rada. Praktična primjena računala u analizi bioloških podataka U računalnoj učionici studenti moraju prezentirati vještinu korištenja bioinformatičkih alata za analizu genomskih podataka. Uz pomoć internetskih alata i baza podataka potrebno je unijeti podatke genomske studije, pokazati odgovarajuću analizu i odgovoriti na određena pitanja.
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☑ Računalna analiza bioloških podataka ☐ ☐ ☐
Student obligations	

Monitoring student work

Class attendance	0.5	Research		Practical work	1
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums		Oral exam			
Written exam	1	Project			

Assessment and evaluation of student work	Metode ocjenjivanja • Praktični zadatak iz genomike - bioinformatička analiza sekvence DNA Korištenjem bioinformatičkih alata studenti zadanu komplementarnu sekvencu molekule DNA (cDNA), nepoznatog porijekla, analiziraju na način da u mrežnoj bazi podataka identificiraju gen i organizam kojem pripada. Osim toga, prikazati će postupak poravnavanja višestrukih sekvenci DNA pomoću alata za analizu sekvenci i odrediti razlike u njihovom slijedu. • Prezentacija seminarskog rada Studenti će morati pripremiti prezentaciju koja prikazuje pregled znanstvene problematike s kojom se bave. Prezentacija će biti ocijenjena prema sadržaju prezentacije (ključne riječi, kritički pregled literature, prezentacija znanstvenih rezultata), formatu, inovativnosti i jezičnoj kompetenciji. • Redovito pohađanje nastave također će biti dio ocjene. • Znanje usvojeno na predavanjima bit će ocijenjeno kroz pismeni ispit (esejska i pitanja u obliku višestrukog izbora odgovora). Konačna ocjena se izvodi na temelju ukupnih bodova za pojedine kategorije vrednovanja.

Required literature

Title	Number of copies available	Availability on other medium
Geoffrey M. Cooper, Robert E. Hausman - Stanica_ molekularni pristup-Medicinska naklada (2010)		

Supplementary literature	Strachan, Tom & Read, Andrew - Human Molecular Genetics-Garland Science (2019) Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick - Lewin's Genes XII-Jones & Bartlett (2018)
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Multimodal Interaction and Iinterfaces</td></tr>
<tr><td>ID</td><td>PMIH50</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Andrina Granić</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>25%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Humans are using multimodality extensively to communicate with each other, either simultaneously in face-to-face conversations or alternatively using speech, writing, gestures, touch. The communication with computers has on the other hand traditionally employed few modalities: the user provides input with keyboard or mouse and the computer responds visually, in the form of text or icons.
This course gives an introduction to new interfaces that can improve the experience or the efficiency of the interaction with computers such as voice control, sound interaction, gesture recognition, touch screens, haptic feedback, augmented reality.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">It would be preferable if students have already acquired basic knowledge from the course Human-Computer Interaction: Fundamental Principles.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After completing the course students should be able to:
- describe the functionality of state-of-the-art multimodal or alternative HCI interfaces,
- evaluate the strengths and weaknesses of multimodal interfaces,
- implement human-computer interaction interfaces employing new interaction techniques for restricted tasks,
- propose efficient designs for new interfaces employing different modalities.
The aforementioned is important in order to be able to:
- deepen knowledge about the interaction modalities of interest in advanced courses,
- employ multimodality in applied project work,
- choose suitable interfaces for a given task (from an HCI and technical perspective).</td></tr>
<tr><td>Syllabus</td><td colspan="3">The course will give the students theoretical and practical introductions to multimodal communication and different types of HCI interfaces.
The course is focused around a group project to create, analyse and/or evaluate a multimodal or innovative interface for a given task. In order to prepare for the project, introductory lectures and laboratory exercises present different interface technologies, and home assignments are solved to provide an adequate background and planning.
The main focus is on techniques for (i) user input, such as speech recognition, touch screens or eye and gesture tracking, and (ii) computer output, such as unconventional display devices, speech synthesis, sounding objects and haptic devices. In particular, the effects of combining different modalities are addressed.
Lectures:
1. Introduction to multimodal interfaces
2. Mixed Reality
3. Tabletops, Tangibles and Tracking
4. Gesture-based interfaces
5. Sound in interaction
6. Speech interfaces
7. Multimodal conversational interfaces
8. Haptic interfaces
9. Individual home assignments - analysis and discussion
10. Seminars
Exercises:
1. Eye tracking interfaces (Tobii)
2. Gesture interfaces (Kinect, Leap)
3. Haptic interfaces (Falcon)
4. Sound /speech interfaces
5. Tactile interfaces (Smart Phone with tactile feedback)
6. Group projects
7. Preliminary /final exams</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia</td><td>☐
☐</td></tr>
</table>

	☐ Fully online ☐ Combined online	☑ Laboratory ☑ Mentoring	☐ ☐
Student obligations	Active participation in all activities: lectures, consultations, searching the literature, individual home assignments, seminars and group work; preliminary (mid-term) /final exams		

Monitoring student work						
	Class attendance	1	Research		Practical work	1
	Experimental work	1	Paper			
	Essay		Seminar paper	1		
	Colloquiums		Oral exam			
	Written exam	1	Project			

Assessment and evaluation of student work	Seminars (10%) Individual home assignments (10%) Group projects (30%) Preliminary /final exams (50%)

Required literature	Title	Number of copies available	Availability on other medium
	Dumas, B., Lalanne, D., Oviatt, S. (2009). Multimodal Interfaces: A Survey of Principles, Models and Frameworks. In Denis Lalanne, Jürg Kohlas eds. Human Machine Interaction, LNCS 5440, Springer-Verlag, Berlin/Heidelberg, pp. 3-26. Oviatt S. (1999). Ten myths of multimodal interaction. Communications of the ACM, 42(11), pp. 74 - 81. Reeves et al. (2004). Guidelines for multimodal user interface design. Communications of the ACM, 47 (1), pp. 57-59. Olwal, A. (2009). An Introduction to Augmented Reality. Schöning et al. (2008). Multi-Touch Surfaces: A Technical Guide. Technical Report TUMI0833. Jacob, R. and Kam, K. (2003). Eye Tracking in Human-Computer Interaction and Usability Research: Ready to Deliver the Promises. In Hyona et al. (Eds.), The Mind's eye: Cognitive and Applied Aspects of Eye Movement Research (pp. 573-603). Mitra, S. and Acharya, T. (2007). Gesture recognition: A Survey. IEEE Transactions On Systems, Man and Cybernetics - Part C, 37(3), 311-324. Rocchesso, D., & Bresin, R. (2007). Emerging sounds for disappearing computers. In Streitz, N., Kameas, A., & Mavrommati, I. (Eds.), The Disappearing Computer (pp. 233-254). Berlin Heidelberg: Springer. Mohamed Yacine Tsalamlal, Nizar Ouarti, Mehdi Ammi. (2013). Non-intrusive Haptic Interfaces: State-of-the Art Survey. In Haptic and Audio Interaction Design. LNCS Volume 7989, 2013, pp 1-9.		Yes
	Oviatt S. (1999). Ten myths of multimodal interaction. Communications of the ACM, 42(11), pp. 74 - 81.		Yes
	Reeves et al. (2004). Guidelines for multimodal user interface design. Communications of the ACM, 47 (1), pp. 57-59.		Yes
	Olwal, A. (2009). An Introduction to Augmented Reality.		Yes
	Schöning et al. (2008). Multi-Touch Surfaces: A Technical Guide. Technical Report TUMI0833.		Yes
	Jacob, R. and Kam, K. (2003). Eye Tracking in Human-Computer Interaction and Usability Research: Ready to Deliver the Promises. In Hyona et al. (Eds.), The Mind's eye: Cognitive and Applied Aspects of Eye Movement Research (pp. 573-603).		Yes
	Mitra, S. and Acharya, T. (2007). Gesture recognition: A Survey. IEEE Transactions On Systems, Man and Cybernetics - Part C, 37(3), 311-324.		Yes

	Rocchesso, D., & Bresin, R. (2007). Emerging sounds for disappearing computers. In Streitz, N., Kameas, A., & Mavrommati, I. (Eds.), The Disappearing Computer (pp. 233-254). Berlin Heidelberg: Springer.		Yes
	Mohamed Yacine Tsalamlal, Nizar Ouarti, Mehdi Ammi. (2013). Non-intrusive Haptic Interfaces: State-of-the Art Survey. In Haptic and Audio Interaction Design. LNCS Volume 7989, 2013, pp 1-9		Yes
Supplementary literature			
Quality assurance	student discussion, anonymous student evaluation questionnaire, student success rate, self-assessment		
Other (in the opinion of the proponent)			

Subject name	Advanced Electrodynamics		
ID	PMP113	Study year	3.
Lecturer	izv. prof. dr. sc. Petar Stipanović	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 45, S: 15, E: 30, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description	
Subject goals	Formulation of the laws of classical and relativistic electrodynamics and special theory of relativity, with the development of mathematical methods and critical judgment of their applicability in selected physical problems.
Enrolment requirements	Prior knowledge of mathematical analysis (differential and integral calculus with functions of several variables) and differential equations is required. – Mathematical Methods of Physics I (passed) – Differential Equations (attended) – Electricity and Magnetism (passed) – Waves and Optics (attended) – Classical Electromagnetism (enrolled)
Learning outcomes	1. Formulate basic quantities and laws of classical electrodynamics in vacuum and matter (Maxwell's equations in classical and tensor form, Poynting's vector, Poynting's theorem, Maxwell's tensor, retardation potentials, Jefimenko's equations, Lienard-Wiechert potentials, Larmor's formula, etc.) using vector and tensor analysis and Einstein's convention, when needed and within the framework of the special theory of relativity. 2. Formulate the given problem with differential equations and apply Green's functions in the solution. 3. For the given dynamic charge/current distributions, estimate the electromagnetic potentials and fields, estimate their dis-/continuity at the edge, apply quasi-static approximations if necessary and sketch the dependence of quantities. 4. Chose appropriate conservation laws (charge, energy, momentum) and equivalent quantities to simplify the complex and dynamic distributions of charges and currents. 5. Examine the laws of geometric optics and Fresnel’s equations using Maxwell's equations; construct simple models of wave incidence on a conductor, absorption, dispersion and propagation of electromagnetic waves through the waveguides. 6. Formulate classical electrodynamics using scalar and vector potential, performing gauge transformations and estimating retardation effects. 7. Argue approximations in models of electric/magnetic dipole radiation, of arbitrary charge density, and of a point charge in motion. 8. Formulate space-time transformations for ideal systems in a relatively uniform motion by using Einstein’s postulates of the special theory of relativity; and evaluate their influence on the transformations of electromagnetic fields. 9. Formulate Maxwell equations in covariant form.
Syllabus	Seminars and exercises following the lectures in units: **(3h) Maxwell's formulation of classical electrodynamics** (Maxwell's equations and boundary conditions, linear and nonlinear matter) **(6h) Conservation laws of charge, energy, momentum** (continuity equation, Poynting's vector, Poynting's theorem, Maxwell's tensor) **(12h) Electromagnetic waves** (laws of geometrical optics in vacuum and matter, absorption and dispersion, waveguides) **(6h) Potential formulation of classical electrodynamics** (gauge transformations of scalar and vector potentials, retarded potentials, Lienard-Wiechart potential, Jefimenko’s equations) **(9h) Radiation** (radiation of electric/magnetic dipole, of arbitrary charge density and of point charge in motion) **(9h) Relativistic electrodynamics** (special theory of relativity, transformations of mechanical quantities and electromagnetic fields, tensor formulation of classical electrodynamics)
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐

Student obligations	1. Active participation on lectures by giving critical judgment and argumentation of opinions, asking and answering questions. 2. Solve given problems from electromagnetism. 3. Discuss given concepts and laws and their applicability.					
Monitoring student work	Class attendance	3	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	0.5		
	Colloquiums		Oral exam	1.5		
	Written exam	1	Project			
Assessment and evaluation of student work	The final grade is formed after the student passes both test parts: written exam (problem solving, 50% rating) and oral exam (theory, 50% rating). During classes, short tests of learning outcomes are carried out, through which it is possible to be exempted from part of the exam, and colloquia (problems tasks) which are equivalent to the written exams.					
Required literature	Title	Number of copies available	Availability on other medium			
	[1] David J. Griffiths: Introduction to Electrodynamics, Cambridge University Press, 2017.	13	yes			
	[2] I. Supek: Teorijska fizika i struktura materije, Školska knjiga.	11	no			
	[3] Lecture notes		yes			
Supplementary literature	[4] John David Jackson: Classical electrodynamics, Wiley, New York. [5] Different www–materials from electromagnetism.					
Quality assurance	1. Lecturers who teach subjects, which have correlated learning outcomes, collaborate and take care of teaching quality. 2. Statistics of exam results and evaluation of efficacy in accordance with the learning outcomes. 3. Student evaluation by anonymous survey conducted according to the rules of the University of Split.					
Other (in the opinion of the proponent)						

Subject name	Advanced Quantum Physics		
ID	PMP200	Study year	1.
Lecturer	prof. dr. sc. Leandra Vranješ Markić	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L | S | E | P 30 | 15 | 30 | 0
Subject status	Compulsory	Online percentage	10%
Subject description			
Subject goals	Extend students' ability in applying the basic formalism of quantum mechanics to understanding and predicting the behavior of physical systems for which the Schrodinger equation cannot be analytically solved, such as multielectron atoms. Understanding and applying interference calculations, solving scattering problems. Introduce students to concepts that will allow them to monitor new results related to the interpretation and modern applications of quantum mechanics.		
Enrolment requirements	Knowledge of basic concepts of quantum mechanics and ability to apply to simple problems and the hydrogen atom.		
Learning outcomes	At the end of the course student should be able to: 1. Apply the appropriate method (time-independent perturbation theory, variational method, WKB method) to approximately determine stationary states and validity limits of obtained solutions. 2. Discuss the pictures of quantum physics (Schroöinger, Heisenberg and Dirac picture). 3. Analyse the time-dependent perturbation theory and apply it in examples with important time-dependent potentials (costant in a time interval, harmonic change, sudden and adiabatic change). 4. Explain the quantisation of electromagnetic field and basics of quantum optics and apply them in simple examles. 5. Discuss main concepts in quantum scattering theory and important approximations and apply them in scattering examples without spin 6. Discuss concepts of identical particles, wave-function symmetry with respect to exchange of the particles, connection between spin and quantum statistics and the role of quantum statistics, especially in the periodic table of elements. 7. Choose appropriate method for approximate determination of the many-particle systems and determine the validity limits of obtained solutions (Hartree-Fock, variational method, molecular dynamics) 8. Apply the methods of quantum physics in description of important many-particle systems, atoms and molecules (helium atom, ions of hydrogen molecule) 9. Explain quantum coupling and measurement problems and modern applications of quantum mechanics: quantum computing, quantum teleportation and quantum cryptography.		
Syllabus	1. Addition of angular moments. 7 hours 2. Time-independent perturbation, non-degenerate and degenerate systems. 8 hours 3. Application of perturbation theory: Zeeman effect. Stark effect. Fine and hyperfine structure. 8 hours 4. Variation principle. Application to the helium atom. 4 hours 5. WKB method. 6 hours 6. Pictures of quantum mechanics. Time-dependent perturbation theory and application 8 hours 7. Quantization of electromagnetic filed and selection rules for electromagnetic radiation. 6 hours 7. Scattering theory. Bourne approximation. Partial wave method. 8 hours 8. Multiparticle Schroedinger equation. Wave function of identical particles. 5 hours		

	9. Multielectron atoms. Helium atom. Periodic table of the elements. 5 hours 10. Hydrogen ion and molecule. Molecular spectra. 4 hours 11. Quantum entanglement. EPR argument. Bell's inequalities. Schroedinger's cat. 3 hours 12. Quantum teleportation. Quantum cryptography. Elements of quantum computing theory. 3 hours
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Active participation in the classes

Monitoring student work:

Class attendance	2.5	Research		Practical work	
Experimental work		Paper		Independent work	3.5
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	Written exam (or colloquia) and oral.

Required literature:

Title	Number of copies available	Availability on other medium
[1] N. Zettili, "Quantum mechanics: concepts and applications".	4	
[2] Various websites with solved examples in quantum mechanics.	0	
[3] Popular and scientific articles and presentations (quantum coupling, quantum cryptography, teleportation, quantum computing).	0	

Supplementary literature	1. R. Scherrer „Quantum mechanics: An Accessible Introduction“ 2. R. L. Liboff, „Introductory Quantum Mechanics“ 3. Auletta, Genaro, Parisi, “QuantumMechanics” 4. D. J. Griffits, “Introduction to QuantumMechanics”
Quality assurance	Monitoring success in colloquia and exams. Discussion with students and analysing their progress in solving problem and assignments. Student evaluation by anonymous survey conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="6">Advanced models of teaching</td></tr>
<tr><td>ID</td><td>PMS201</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Sonja Kovačević</td><td>Points value (ECTS)</td><td colspan="4">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>15</td><td>15</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">The aim of the course is to introduce students to different theories , systems and process models of teaching and learning with a critical and creative attitude towards educational theory and practice ; to get to know different theoretical and methodological points of educational process ; to learn about the developmental continuity of instruction ; to learn about the different concepts (theories)of development and education; to get to know the difference between traditional and modern systems and models of teaching and learning ; to see different systems and models of teaching and their characteristics; to be able to organize teaching in accordance with the different systems and models of teaching and learning ; to be able to transfer knowledge and interference on different situations of educational processes ; to be motivated to research systems and models of teaching and learning .</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Passed examination in Didactics</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Students are expected to develop the following general competencies :
- Identify and analyze the reasons for the existence of a number of theories , systems and models of teaching and learning
- - Identify the complexity of the educational process
- Explain and analyze the developmental continuity of instruction
- Identify and compare the different paradigmatic bases and scientifically theoretical positions of science on e
ducation
- List traditional and modern systems and models of teaching and learning
- Compare and analyze traditional and modern systems and models of teaching and learning
- Analyze the fundamental elements of the teaching process in different systems and models of teaching and learning
- Vary the basic structure and function of individual systems
- Prepare , implement and evaluate the lessons according to the different models in the process of teaching and learning
- Identify and describe the impact of the organization of teaching on students' development .</td></tr>
<tr><td>Syllabus</td><td colspan="6">The reasons for the existence of multiple systems and models of teaching and learning .
The complexity of teaching and learning .
Diversity of approach in teaching and learning .
Diversity of paradigmatic bases and scientifically - theoretical positions of science on education .
The diversity of methodological starting points .
The basic features of communication , purpose , objectives and tasks , relationship between participants .
Models of teaching :
Transmission model of teaching
Transaction teaching model
Transformation model of teaching
Post-postmodern Maieutics
Post-industrial society
Company knowledge
The concept of lifelong learning
Socratic dialogue
Theories of other modernization or post-postmodern
Theory of McDonaldisation
The theory of the society of risk
The theory of fluid society
The theory of the network society</td></tr>
</table>

	The theory of communicative action Critical Pedagogy Constructivism Experiential learning theory Critical thinking – Sapere Aude					
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises		☐ Fieldwork ☐ Individual assignments ☑ Multimedia		☐ ☐	
	☐ Fully online ☐ Combined online		☐ Laboratory ☐ Mentoring		☐ ☐	
Student obligations	Participants are required to attend all forms of instruction, and actively participate in class, which includes the performance of individual assignments, preparation of an e-portfolio, monitoring of relevant literature according to the suggestions of teachers and successfully passing the final exam.					
Monitoring student work	Class attendance		Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project			
Assessment and evaluation of student work	Assessment and evaluation of students will be defined by the implemented curriculum.					

Required literature	Title	Number of copies available	Availability on other medium
	Kovačević, S.,Mušanović, L. (2013), Od transmisije do majeutike – modeli nastave, HFD, Rijeka.		
	Jensen, E. (2003), Super nastava. Zagreb: Educa		

Supplementary literature	* (1993), Didaktičke teorije. Zagreb: Educa. Bošnjak, B. (1998), Drugo lice škole. Zagreb: Alinea.
Quality assurance	Evaluation lists, exam accomplishments
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="7">Nasilje među djecom</td></tr>
<tr><td>ID</td><td>PMS176</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Anna Alajbeg</td><td>Points value (ECTS)</td><td colspan="4">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>15</td><td>15</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Upoznati studente s fenomenom klasičnog i elektroničkog vršnjačkog nasilja. Razumijevanje osnovnih
utjecaja različitih vrsta nasilja na psihosocijalni razvoj djece i posljedice u kasnijoj dobi. Razviti sposobnost odabira adekvatnih metoda u prevenciji i intervenciji u činu vršnjačkog nasilja</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6"></td></tr>
<tr><td>Learning outcomes</td><td colspan="6">• Interpretirati i klasificirati znanstveno utvrđene oblike nasilja među djecom
• Osposobljenost za identifikaciju različitih oblika klasičnog i elektroničkog vršnjačkog nasilja
• Prepoznati i objasniti rizične čimbenike na individualnoj i društvenoj razini za pojavu
fenomena nasilja među djecom
• Kritički procjenjivati i određivati primjerene metode postupanja na razini primarne prevencije;
• Planirati profesionalno utemeljene postupke u skladu sa zakonskom regulativom.
• Sposobnost ranog uočavanja problema vršnjačkog nasilja
• Razvoj kompetencija za pomaganje djeci koja su sudjelovala u nasilju
• Pripremljenost za suradnju s drugim stručnjacima i obiteljima te službeno postupanje
(prijava) u slučajevima nasilja i zlostavljanja</td></tr>
<tr><td>Syllabus</td><td colspan="6">Nastavni sat predavanja Nastavu izvodi
1. Uvodni sat – upoznavanje s kolegijem Anna Alajbeg
2. Nasilje među djecom – povijesni pregled Anna Alajbeg
3. Sukobi, nasilje i zlostavljanje – terminološko određenje Anna Alajbeg
4. Oblici i obilježja klasičnog vršnjačkog nasilja Anna Alajbeg
5. Oblici i obilježja elektroničkog vršnjačkog nasilja Anna Alajbeg
6. Individualni čimbenici rizika i zaštite u vršnjačkom nasilju Anna Alajbeg
7. Obiteljski čimbenici rizika i zaštite u vršnjačkom nasilju Anna Alajbeg
8. Školski čimbenici rizika i zaštite u vršnjačkom nasilju Anna Alajbeg
9. Uloge djece u klasičnom nasilju među djecom Anna Alajbeg
10. Uloge djece u elektroničkom nasilju među djecom Anna Alajbeg
11. Posljedice klasičnog i elektroničkog vršnjačkog nasilja Anna Alajbeg
12.–13. Zaštita, postupanje i prevencija vršnjačkog nasilja Anna Alajbeg
14. Priprema za kolokvij Anna Alajbeg
15. Kolokvij Anna Alajbeg

Nastavni sat seminara Nastavu izvodi
1. Podjela seminarskih radnji. Upute za pisanje seminarskih
radnji Anna Alajbeg
2. Zakonska regulativa i pravna zaštita djece u Republici
Hrvatskoj Anna Alajbeg
3. Teorijski modeli nasilnih roditeljskih ponašanja prema djeci Anna Alajbeg
4. Nasilje u mladenačkim vezama Anna Alajbeg
5. Rizični i zaštitni čimbenici za zlostavljanje djece Anna Alajbeg
6. Tjelesno kažnjavanje djece Anna Alajbeg
7. Emocionalno zlostavljanje Anna Alajbeg
8. Seksualno zlostavljanje, posljedice i tretman Anna Alajbeg
9. Razvod roditelja i manipulacija djecom pri razvodu roditelja Anna Alajbeg
10. Mediji i nasilje među djecom Anna Alajbeg
11. Karakteristike počinitelja s obzirom na vrstu nasilja Anna Alajbeg
12. UNICEF-ov preventivni program „Stop nasilju među djecom“ Anna Alajbeg
13. UNICEF-ov preventivni program „Stop nasilju među djecom“
– prevencija elektroničkog zlostavljanja Anna Alajbeg
14. Olweusov preventivni program Anna Alajbeg
15. KiVa preventivni program Anna Alajbeg</td></tr>
</table>

Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online		☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring		☐ ☐ ☐ ☐	
Student obligations	Redovito pohađanje i aktivno sudjelovanje u nastavi, seminari (pozitivno ocijenjen napisani seminarski rad i prezentacija), polaganje kolokvija ili ispita.					
Monitoring student work	Class attendance	0.5	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	0.5		
	Colloquiums	0.5	Oral exam	0.5		
	Written exam		Project			
Assessment and evaluation of student work	Završna ocjena iz kolegija Nasilje među djecom određuje se temeljem uspjeha postignutom na kolokviju tijekom predavanja i seminara. Studenti moraju napisati jedan seminarski rad u kojem će obraditi zadanu temu s popisa tema seminarskih radova. Seminar se ocjenjuje ocjenom od 1 do 5. Ocjena iz teorijskog dijela određuje se temeljem uspjeha postignutog na usmenom teorijskom kolokvijiu koji se održava u petnaestom tjednu nastave. Usmeni odgovori studenata ocjenjuje se ocjenom od 1 do 5. Konačna ocjena iz kolegija Nasilje među djecom izračunava se na sljedeći način: (ocjena teorija) + (ocjena seminar) + (redovitost i zalaganje na nastavi).					
Required literature	Title	Number of copies available	Availability on other medium			
	Bilić, V. (2018). Nove perspektive, izazovi i pristupi nasilju među vršnjacima. Obrazovni izazovi i Učiteljski fakultet u Zagrebu. Zagreb					
	Bilić, V., Buljan Flander, G., Hrpka, H. (2012). Nasilje nad djecom i među djecom. Jastrebarsko: Naklada Slap					
	Olweus, D. (1993). Nasilje među djecom u školi. Zagreb: Školska knjiga					
Supplementary literature	Bilić, V. i Zloković, J. (2004). Fenomen maltretiranja djece, Naklada Ljevak, Zagreb. Pregrad, J. i sur. (2007). Priručnik Stop nasilju među djecom, UNICEF Zagreb.					
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split					
Other (in the opinion of the proponent)						

Subject name	Normed spaces						
ID	PMM605	Study year	1.				
Lecturer	prof. dr. sc. Vlasta Matijević	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			45	0	0	0	
Subject status	Compulsory	Online percentage	30%				

Subject description

Subject goals	The course objective is to introduce students with advanced knowledge of normed spaces with special emphasis on Hilbert and Banach space theory. This gives the basics for more advanced studies in modern functional analysis, in particular in operator algebra theory.
Enrolment requirements	Courses taken: Metric spaces, Vector spaces
Learning outcomes	It is expected that a student will – understand special properties of basic topological concepts (convergence, continuity, compactness) and metric concepts (boundedness, total boundedness, completness, uniform continuity) in normed spaces – be able to state and prove basic results about Hilbert and Banach spaces and bounded operators between such spaces – be able to apply the theory in the course to solve a variety of problems at an appropriate level of difficulty – be able to decide whether a simple statement about normed spaces and bounded operators is true, providing a proof or counterexample as appropriate – develop critical and analytical thinking and demonstrate skills in communicating mathematics orally and in writing
Syllabus	– Basic notions (12 hours) Algebraic basis and dimension of a vector space. Norm and inner product. Equivalence of norms. Bounded linear operators. Normed space of bounded linear operators. Dual space of a normed space. Complete normed space. Completion of a normed space. Riesz lemma. Finite-dimensional normed space. Schauder basis of a normed space. – Spaces lp and Lp (8 hours) Spaces lp and their dual spaces. Spaces Cp([a,b]) and their completions Lp([a,b]) – Separable inner product and Banach spaces (7 hours) Orthonormal basis. Structure theorems for infinite dimensional separable inner product and Banach spaces. – Hahn-Banach extension theorem and consequences (6 hours) – Hilber spaces (6 hours) Riesz projection theorem. Riesz representation theorem. Characterization of Hilbert spaces. – Classical theorems of functional analysis (6 hours) Uniform boundedness principle. Banach-Steinhaus theorem. The open mapping theorem. Banach inverse mapping theorem. The closed graph theorem.
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Attendance at lectures, seminars and exercises, written assignments, self-study using required and optional literature

Monitoring student work	Class attendance	1.5	Research		Practical work	
	Experimental work		Paper		Ispit	4.5
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project			

Assessment and evaluation of student work	The exam consists of written and oral part. The oral part comes after positively graded (at least 50%) written part Both parts of the exam are equally evaluated in the final grade.

Required literature		Number	

	Title	of copies available	Availability on other medium
	E. Kreyszig, Introductory functional analysis, John Wiley and sons, New York, 1978.		da
	S. Kurepa, Funkcionalna analiza, Liber, Zagreb, 1992		
	J.J. Koliha, Metrics, Norms, Integrals, World Scientific, London, 2008.		
Supplementary literature	G. Bachman, L. Narici, Functional analysis, Dover Publications, New York, 2000.		
	W. Rudin, Functional analysis, McGraw-Hill, New York, 1973.		
Quality assurance	Exam statistics and students' quality evaluation through anonymous poles.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="7">Nuclear Physics</td></tr>
<tr><td>ID</td><td>PMP203</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Ivana Weber</td><td>Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">20%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Understanding the basic properties of atomic nuclei, basic models, including laws, that describe states and processes in atomic nuclei.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Learning outcomes foreseen in subjects: General Physics; Quantum physics</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. Describe basic discoveries and current topics in nuclear physics.
2. Critically discuss and apply basic models that describe atomic nucleus.
3. Explain the main concepts of nuclear physics such as cross-section, nuclear decay, scattering, fusion, fission, radioactivity, using appropriate physical quantities and corresponding units.
4. Explain the processes of nuclear reactions.
5. Explain basics of nucleosynthesis for light and heavy elements.
6. Describe the typical experimental techniques and devices used in nuclear physics.
7. Critically discuss the application of nuclear processes and their impact on life and environment.</td></tr>
<tr><td>Syllabus</td><td colspan="6">1. Introduction. The structure of the nuclei, basic nuclear properties.
2. The mass and size of the nuclei. Nuclear properties in the ground state.
3. Nuclear forces. Total angular momentum, spin and magnetic momentum.
4. Nuclear models: Mean potential model.
5. Nuclear models: Fermi gas model.
6. Nuclear models: Liquid-drop model.
7. Nuclear models: Shell model.
8. Nuclear models: Collective model.
9. Radioactivity.
10. Nuclear decays: Alpha decay.
11. Nuclear decays: Quantum-mechanical model of alpha-decay.
12. Nuclear decays: Beta and gamma decay.
13. Nuclear reactions. Cross-section; Transport of particles through matter.
14. Nuclear fission. Nuclear fusion.
15. Nuclear processes in stars. Radiation and life.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="3">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="2">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Passed exams: Numerical problems and theories. Success in each of at least 50%.</td></tr>
<tr><td>Monitoring student work</td><td colspan="6">
<table>
<tr><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td>Osnovna svojstva jezgri</td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1.5</td><td>Nuklearni modeli</td><td></td></tr>
<tr><td>Written exam</td><td>1.5</td><td>Project</td><td></td><td>Nuklearni raspadi</td><td></td></tr>
</table>
</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Students will be evaluated during the semester and the final exam. Successful final exam can replace all obligations.</td></tr>
<tr><td>Required literature</td><td colspan="6">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Ivana Weber, Osnove nuklearne fizike, lectures, University of Split, 2020</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Supplementary literature</td><td colspan="6">[1] A. Beiser, Concepts of Modern Physics, Mc Graw-Hill, 2003.
[2] J.-L. Basdevant, J. Rich, M. Spiro, Fundamentals in Nuclar Physics, Springer, 2005.</td></tr>
</table>

	[3] W. N. Cottingham, D.A. Greenwood, An Introduction to Nuclear Physics, Second Edition, Cambridge University Press, 2001. [4] S. S. M. Wong, Introductory Nuclear Physics, Second Edition, Wiley & Sons, New York, 1998.
Quality assurance	~~Regular validation of learning outcome during class.~~ Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Numerical analysis		
ID	PMM118	Study year	1.
Lecturer	izv. prof. dr. sc. Jurica Perić	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Elective	Online percentage	40%

	L	S	E	P
Class execution (number of hours in semester)	30	0	30	0

Subject description

Subject goals	Students will acquire knowledge and skills in numerical analysis, especially in the field of analysis of errors in computer arithmetic, numerical solution of ordinary differential equations and partial differential equations. This will enable them to solve problems that arise in practice, especially in the natural sciences (such as, physics), technical sciences, ... Also they will become familiar with some of the existing software packages which can be used in solving such problems.
Enrolment requirements	Successfully completed course „Introduction to numerical mathematics“.
Learning outcomes	The student is able to: – estimate and classify errors when executing algorithms in computer – explain and analyze advanteges and disadvanteges of representation of real and integer numbers into computer, IEEE arithmetic – choose one of the studied methods and solve the initial (or boundary) problem for ordinary differential equation – compare and relate concepts method order, consistency, convergence, stability – explain studied methods for numerical solving of partial differential equations
Syllabus	Representation of the number in computer, computer arithmetic – 4 hours Analysis of errors – 4 hours Ordinary differential equations: initial problem (one-step and multi-step methods, especially Runge-Kutta methods), boundary problem, variational approach – 14 hours Introduction to numerical solution of partial differential equations: elliptic, parabolic and hyperbolic differential equations – 8 hours
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Attendance at 70% of lectures and 70% of exercises.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	1.5	Oral exam	1.5		
Written exam	1	Project			

Assessment and evaluation of student work	The exam is taken in written and oral form. Written exam is preliminary part of the exam and requirement for the oral exam is to pass a written exam. The written form of the exam can be taken partially, during class, where curriculum provided. Activity in class, solving homework, colloquium, written and oral examination are the elements from which form the final grade is formed.

Required literature

Title	Number of copies available	Availability on other medium
V. Hari at all, Numerička analiza, PMF-MO, Zagreb, 2003.		
J. Stoer, R. Bulirsch, Introduction to Numerical Analysis, Springer, New York, 1993.		
Nicholas J. Higham, Accuracy and Stability of Numerical Algorithms, SIAM, 2002.		

Supplementary literature	D. Kincaid, W. Cheney, Numerical Analysis - Mathematics of Scientific Computing, Brooks/Cole Publishing Company, 2002.

	D. N. Arnold, A Concise Introduction to Numerical Analysis, University of Minnesota, Minneapolis, 2001
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Numerička linearna algebra</td></tr>
<tr><td>ID</td><td>PMM210</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Ivan Slapničar</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>40%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Introducing methods of numerical linear algebra that are commonly used in scientific and technical applications, the ability to assess the accuracy of the method, the ability to make own algorithms and the use of existing programming libraries.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Successfully completed courses „Linearna algebra“, „Foundation of mathematical analysis“.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">The student is able to:

operate with basic theorems in the theory of optimal approximation (approximation from a given set, the existence, uniqueness)
reproduce basic matrix norms and their properties
analyze differences in solving system of linear equations, solve system of linear equations using Gaussian algorithm (LU factorization, LU factorization with pivoting) and Cholesky algorithm
examine the numerical properties if operations in the algorithm are performed on the computer in the final precision arithmetic
explain and use SVD decomposition
Analyze orthogonal diagonalization of a matrix
explain Householders factorization and its advantages</td></tr>
<tr><td>Syllabus</td><td colspan="3">The fundamental ideas of linear algebra: basic algorithms on matrices, vector and matrix norms. – 2 hours
Computer arithmetic. – 2 hours
Systems of linear equations: Gauss algorithm, Cholesky algorithm, accuracy and improvement of accuracy. – 4 hours
Iterative methods. – 2 hours
Least squares problem (LS) and QR decomposition. – 4 hours
Eigenvalue problem for symmetric matrices: QR method, Jacobi method. – 4 hours
Gram-Schmidt orthogonalization, Householder factorization. – 4 hours
Singular Value Decomposition (SVD), fast updating of SVD decomposition (updating and downdating). – 4 hours
Latent Semantic Indexing (LSI) and the application of SVD decomposition for constructing Web browser. – 4 hours</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attendance at 70% of lectures and 70% of exercises.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper:
Colloquiums: 1.5; Oral exam: 1.5
Written exam: 1; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The exam is taken in written and oral form. Written exam is preliminary part of the exam and requirement for the oral exam is to pass a written exam. The written form of the exam can be taken partially, during class, where curriculum provided. Activity in class, solving homework, colloquium, written and oral examination are the elements from which form the final grade is formed.</td></tr>
<tr><td>Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
</table>

	G. H. Golub i C. F. Van Loan: Matrix Computations, 3rd Edition, John Hopkins University Press, Baltimore, Maryland, 1996.		
	E. Anderson i drugi: LAPACK Users' Guide, 2nd Edition, SIAM, Philadelphia 1995.		
	M. W. Berry, Z. Drmač, E. R. Jessup: Matrices, Vector Spaces and Information Retrieval, SIAM Review, 41 (1999) 335–362.		
	J. W. Demmel, Applied numerical linear algebra, SIAM, 1997.		
Supplementary literature	G. W. Stewart, Afternotes on Numerical Analysis, SIAM, Philadelphia, 1996. G. W. Stewart, Afternotes on Numerical Analysis: Afternotes Goes to Graduate School, SIAM, Philadelphia, 1998		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Numerical Modelling of Weather and Climate		
ID	PMP263	Study year	2.
Lecturer	prof. dr. sc. Darko Koračin	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 20, P: 0
Subject status	Elective	Online percentage	30%

Subject description	
Subject goals	Provide knowledge on: – Theoretical basis and practical applications of using mathematical formalism describing atmospheric dynamics and thermodynamics – Basic physics conservation laws and their representation by differential equations – Numerical solution of differential equations describing atmospheric dynamics and thermodynamics – Basic concepts of atmospheric models
Enrolment requirements	Requirements – Basic physics – Basic mathematics including tensor calculus
Learning outcomes	1. Understanding theoretical concepts of atmospheric models. 2. Knowledge on tensor calculus. 3. Practical knowledge on numerical techniques. 4. Application of numerical schees in solving differential equations. 5. Knowledge on structure of atmospheric models.
Syllabus	1. Basic conservation laws applied to the atmosphere (3h) 2. Surface forces (2h) 3. Stress tenzor (3h) 4. Navier – Stokes equation (2h) 5. Decomposition of basic equations of atmospheric dynamics and thermodynamics (1h) 6. Reynolds averaging (1h) 7. Equations for turbulent fluxes and the turbulence kinetic energy (3h) 8. Scale analysis of the basic equations (1h) 9. Numerical solution of the basic equations (4h) 10. Finite differences, finite elements, semi-lagrangian methods (2h) 11. Stability of numerical schemes (1h) 12. Chaotic behavior of atmospheric processes (1h) 13. Basic concepts of numerical weather prediction (2h) 14. Operational forecasts of weather and climate (4h)
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring ☐ ☐ ☐ ☐
Student obligations	Attending all forms of teaching.

Monitoring student work						
	Class attendance	1.7	Research	1	Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	1.3		
	Colloquiums		Oral exam	1		
	Written exam		Project			

Assessment and evaluation of student work	During each term, the student's knowledge is tested. The final score is based on the knowledge shown during classes, essay and presentations and a final exam.

Required literature	Title	Number of copies available	Availability on other medium
	Pielke, R. A., Sr., 2002: Mesoscale Meteorology Modeling. Academic Press. 676 pp.		
	Randall, D., 2003: An introduction to atmospheric		

	modelling. Department of Atmospheric Science, Colorado State University 2003. Available at http://kiwi.atmos.colostate.edu/group/dave/at604.html.		
	Stull, R., 1988: An Introduction to Boundary Layer Meteorology. Kluwer. 666 pp.		
Supplementary literature	• R.W. Riddaway (revised by M. Hortal): Numerical methods. Revised March 2001. • Meteorological Training Course Lecture Series. WCMWF, 2002 (Free) • E. Kalnay: Atmospheric modelling, data assimilation and predictability. Cambridge university press 2003. • S. Pal Arya (1999): Air pollution meteorology and dispersion		
Quality assurance	1. Analysis of the acquired learning outcomes at the end of the class, compared with the work of students. 2. Monitoring the development of students in the subjects who followed the links with the success of the case. 3. Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="6">Ordinary differential equations</td></tr>
<tr><td>ID</td><td>PMM103</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Andrijana Ćurković</td><td>Points value (ECTS)</td><td colspan="4">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">40%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Introduce students to basic ideas of ordinary differential equations. Assure understanding of basic models. Demonstrate theorems of existence and uniqueness of solution as well as some of the commonly used techniques for finding solutions with emphasis on the theory of linear equations.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Differential and Integral Calculus I</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">After completing the course, students are expected to:

identify real-life problems which can be modeled by differential equations;
explain in their own words conditions that ensures existence and uniqueness of a solution of the Cauchy problem;
distinguish characteristic properties of linear equations and systems from nonlinear ones;
select and apply appropriate methods to solve basic differential equations;
identify and apply initial and boundary values to find particular solution. .</td></tr>
<tr><td>Syllabus</td><td colspan="6">Introduction: Definitions and Terminology. Differential Equations as Mathematical Models (1 week)

First Order Ordinary Differential Equations: Existence and Uniqueness of Solution. Different types of First Order Equations (including ODE with separable variables, homogeneous, Bernoulli, exact) Applications. (4 weeks)

Higher Order Differential Equations: Reduction of Order. Homogeneous Linear Equations with Constant Coefficient. Nonhomogeneous Equations (Undetermined Coefficients, Variation of Parameters). Laplace Transform Methods (5 weeks)

Linear System of First Order Differential Equations: Preliminary Theory. The eigenvalue method for homogeneous systems. Variation of Parameters (3 weeks)

Orthogonal Functions: Orthogonal Functions. Sturm-Liouville Problem. Examples. (2 weeks)</td></tr>
<tr><td>Teaching types</td><td colspan="6">☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring
☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Attend class regularly and take notes. Take exams when scheduled.</td></tr>
<tr><td>Monitoring student work</td><td colspan="6">
<table>
<tr><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>2</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">The final exam consists of a written and an oral part. Successful written exam is required for taking the oral exam. Acceptable results achieved in midterm exams taken during the semester replace the written part of the exam.</td></tr>
<tr><td>Required literature</td><td colspan="6">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>D.G. Zill and M.R. Cullen, Differential Equations with Boundary-Value Problems, Brooks/Cole, Cengage 2009.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">W.E. Boyce and R.C. DiPrima, Elementary Differential Equations and Boundary Value</td></tr>
</table>

	Problems, John Wiley & Sons, Inc., New York, 2012. M. Alić, Obične diferencijalne jednadžbe, skripta, PMF-Zagreb, Matematički odjel, 1994
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="7">Object oriented programming</td></tr>
<tr><td>ID</td><td>PMID30</td><td>Study year</td><td colspan="5">1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Saša Mladenović</td><td>Points value (ECTS)</td><td colspan="5">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td colspan="2">P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td colspan="2">0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="5">25%</td></tr>
<tr><td colspan="8">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="7">This course is designed as an entry level programming course for students who have prior programming experience.
This course introduces the concepts of object-oriented programming to students with a background in the procedural paradigm.
The course begins with a brief review of control structures and data types with emphasis on structured data types and array processing.
It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design.
Other topics include an overview of programming language principles. At the end all of the above mentioned concepts should be used to create a simple computer game.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="7">Students who do not have prior programming experience or who are not confident in their programming ability should complete some introductory programming course offered at the faculty prior to undertaking this course</td></tr>
<tr><td>Learning outcomes</td><td colspan="7">Be able to design simple object-oriented (OO) project using an OO design paradigm and supporting software tools.
Be able to implement an OO model in a high-level OO language using objects, classes, inheritance, arrays, conditionals and iteration.
Be conversant with effective documentation, layout, debugging and testing.
Explain the benefits of object oriented design and the types of systems in which it is an appropriate methodology.
Apply good programming style and understand the impact of style on developing and maintaining programs. Be able to justify programming style choices.
Design and implement a suitable GUI for the front-end of an event driven object oriented program.</td></tr>
<tr><td>Syllabus</td><td colspan="7">Introductory concepts about information systems
Basic concepts in object oriented programming
Decomposition
Using methods
Using advanced methods
Using classes and objects
Inheritance
Midterm exam
Game engine for 2D computer game
Example of game development using game engine
Exception handling
Events
Delegates
Graphical user interface controls
Project presentation</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☑ Combined online</td><td colspan="2">☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☑ Laboratory
☐ Mentoring</td><td colspan="4">☑ Domaće zadaće
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="7">Lecture and laboratory attendance, active participation in course activities, homework and project realization, final exam.</td></tr>
</table>

<table>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td>1</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>0.5</td><td>Oral exam</td><td>0.5</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><td></td><td>Written exam</td><td>0.5</td><td>Project</td><td>1.5</td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Attendance/Participation (20%)
Project (40%)
Final/Oral Exam (40%)</td></tr>
<tr><td rowspan="3">Required literature</td><td colspan="3">Title</td><td colspan="2">Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="3">Programiranje C# 4.0 Ian Griffiths, MaZhew Adams i Jesse Liberty (2011) (HRV)</td><td colspan="2">10</td><td></td></tr>
<tr><td colspan="3">Programming C# 4.0 - Building Windows, Web, and RIA Applications for the .NET 4.0 Framework, Ian Griffiths, Matthew Adams, Jesse Liberty, O'Reilly Media (2010) (ENG)</td><td colspan="2"></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">Related Research Papers</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Student discussion, anonymous student evaluation questionnaire, student success rate, self-assessment</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="6">Renewable Energy Sources</td></tr>
<tr><td>ID</td><td>PMT179</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Ivan Peko</td><td>Points value (ECTS)</td><td colspan="4">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>15</td><td>15</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">30%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Enabling students to:
– Acquisition of basic knowledge in the field of renewable energy sources (their importance, potentials and limitations, advantages and disadvantages),
– The permanent adoption and deepening of knowledge in the field of renewable energy,
– Understanding of modern technologies for the exploitation of renewable energy sources,
– Simple calculations of components and systems for exploitation of renewable energy sources.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">There are no requirements for course enrolment.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Students will be able to after successfully mastering the subject:
1. define and describe the various renewable energy sources (RES),
2. explain the need for renewable energy sources (RES) and critically assess their strengths and weaknesses,
3. sketch simple RES systems,
4. Apply the acquired knowledge in other courses as well as in future teaching practice.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Week 1:
Lecture (2 hours): Introductory lecture. Introducing students to the rules, literature and teaching assignments. Getting to know with the content of the course. Introduction, definitions, problems with the current energy system, possible solutions. Energy statistics.
Week 2: Lecture (1 hour): Solar energy and technology for its use; solar thermal systems.
Seminar (1 hour): Distribution of seminar papers to students.
Week 3:
Lecture (2 hours): Solar energy and technology for its use; solar power plants and photovoltaic systems.
Week 4:
Lecture (2 hours): Wind energy; wind turbines.
Week 5:
Lecture (2 hours): Hydropower; hydroelectric power plants, water turbines.
Week 6:
Lecture (2 hours): Tidal power, energy of ocean currents, sea waves energy, geothermal energy and technology for its exploitation.
Course content broken down in detail by weekly class schedule (syllabus) Week 1:
Lecture (2 hours): Introductory lecture. Introducing students to the rules, literature and teaching assignments. Getting to know with the content of the course. Introduction, definitions, problems with the current energy system, possible solutions. Energy statistics.
Week 2: Lecture (1 hour): Solar energy and technology for its use; solar thermal systems.
Seminar (1 hour): Distribution of seminar papers to students.
Week 3:
Lecture (2 hours): Solar energy and technology for its use; solar power plants and photovoltaic systems.
Week 4:
Lecture (2 hours): Wind energy; wind turbines.
Week 5:
Lecture (2 hours): Hydropower; hydroelectric power plants, water turbines.
Week 6:
Lecture (2 hours): Tidal power, energy of ocean currents, sea waves energy, geothermal energy and technology for its exploitation.
Week 7:
Lecture (2 hours): Biomass energy.</td></tr>
</table>

	Week 8: Lecture (2 hours): Hydrogen Energy Technologies Week 9: Seminar (2 hours): Presentation of seminar papers. Week 10: Seminar (2 hours): Presentation of seminar papers. Week 11: Seminar (2 hours): Presentation of seminar papers. Week 12: Seminar (2 hours): Presentation of seminar papers. Week 13: Seminar (2 hours): Presentation of seminar papers. Week 14: Seminar (2 hours): Presentation of seminar papers. 15th week: Seminar (2 hours): The future of renewable energy sources, conclusions.					
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online		☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring		☑ Consultations ☐ ☐ ☐	
Student obligations	Active participation in lectures. Independent preparation and presentation of the seminar. Active participation in the teaching process.					
Monitoring student work	Class attendance	1	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	1		
	Colloquiums		Oral exam			
	Written exam		Project			
Assessment and evaluation of student work	The exam or checking of acquired competences will be done through seminars. Each student or group of students will receive two tasks / themes that they need to be processed in two seminars and present them to the teacher and their colleagues					
Required literature	Title	Number of copies available	Availability on other medium			
	1. Online lectures about renewable Energy sources,					
	2. B. Labudović, Obnovljivi izvori energije, Energetika marketing, Zagreb, 2002.					
Supplementary literature	1. A. Azapagic, R. Clift, Sustainable Development in Practice, John Wiley & Sons, NY, 2004. 2. V. Knapp, Novi izvori energije, Školska knjiga, Zagreb, 1993. 3. V. Paar, Energetska kriza: gdje (ni)je izlaz?, Školska knjiga, Zagreb, 1984 4. Godfey Boyle, Renewable Energy, Oxford Univesity Press, 2004. 5. Internet					
Quality assurance	– Taking attendance at lectures; – The annual analysis of the success of the examination; – Student survey in order to evaluate teachers; – Feedback from students who have already graduated from the relevance of the course content, – Self-evaluation.					
Other (in the opinion of the proponent)						

<table>
<tr><td>Subject name</td><td colspan="3">Signal Processing in Natural Sciences</td></tr>
<tr><td>ID</td><td>PMP125</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Damir Kovačić</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">To familiarize students with:
– Basic concepts in signal processing that appear in natural sciences
– Key signal processing methods</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Enrolled one of the diploma study programs.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. To describe and classify different types of signals.
2. To define and describe the basic concepts of signal processing theory.
3. To include examples of the application of digital signal processing in natural sciences.
4. To apply knowledge to solve simple signal processing problems.
5. To define and describe the basic concepts of digital processing theory and the analysis of sound and image signals.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Lecture: Introduction – definitions: signal, signal processing, information, system analysis, transformation.
2. Lecture: Continuous and discrete signal representation
3. Lecture: Convolution and deconvolution
4. Lecture: Autocorrelation and signal correlation
5. Lecture: System Realization
6. Lecture: Linear and time-invariant systems
7. Lecture: Fourier Transformation and Signal Spectrum (DFT, FFT)
8. Lecture: Filters
9. Lecture: Transformations and interpolation of signals
10. Exercises: Practical methods of signal analysis
11. Exercises: Spectral signal analysis
12. Exercises: Analog and digital signal processing
13. Exercises: Practical examples of signal processing in natural sciences 1-5 (physics, mathematics, biology, chemistry, technique)</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☑ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">The student is required to attend lectures, seminars and exercises, with a maximum of 20% of excused absences. The student is required to write a term paper with the chosen topic and present it in the form of presentation to colleagues and teacher.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 2; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper: 2
Colloquiums: 1; Oral exam:
Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The grade is determined based on:
– Colloquium (25% grade)
– Seminar paper (50% grade)
– Oral presentation (25% grade)</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>Hrvoje Babić (2001.), Signali i sustavi</td><td></td><td></td></tr>
<tr><td>William Hartmann: Signals, Sound, and Sensation</td><td></td><td></td></tr>
<tr><td>B. P. Lathi (2004.), Linear Systems and Signals</td><td></td><td></td></tr>
</table>
</td></tr>
</table>

Supplementary literature	Oppenheim, Alan, and Alan Willsky. Signals and Systems
Quality assurance	Evaluation of results in accordance with the determined learning outcomes. Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split. Self-evaluation of teacher. Institutional and non-institutional checks.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Selected Topics in Biochemistry</td></tr>
<tr><td>ID</td><td>PPC207</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Matilda Šprung</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>50%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The goal of the course is to enable and encourage students to deepen their knowledge in the field of biochemistry by following the rapid progress of specific areas and topics of particular personal interest.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Biochemistry I</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon completion of the course, students will be able to:
1.recognize areas of biochemistry in rapid development
2.recognize relationships between biochemistry and other scientific disciplines (medicine, ecology, agronomy, etc.)
3.use scientific literature
4.condense the literature studied in the form of a popular science presentation</td></tr>
<tr><td>Syllabus</td><td colspan="3">Course topics depend on recent discoveries in biochemistry and the interest of enrolled students. Each student presents one topic, and the instructor presents three topics of interest to enrolled students.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☑ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">An 80% of class attendance is required. Students must prepare and present a seminar work.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Exam preparation</td><td>0.9</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td>0.1</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Passing the written exams is determined by 50% of the total score, and the questions are created in accordance with the learning outcomes established for each presentation. The written part of the exam comprises 50% of the total score, and the seminar comprises another 50%.</td></tr>
<tr><td>Required literature</td><td colspan="3"><table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Selected scientific articles from the journals such are Nature, TIBS, Annual Reviews in Biochemistry, etc., critically evaluated Internet sources.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3">Personal consultations, completion of partial exams, student survey to evaluate subject and instructor, evidence of class attendance, analysis of passing rate on final exams.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Observational Astronomy		
ID	PMP410	Study year	1.
Lecturer	doc. dr. sc. Koraljka Mužić	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 15, P: 0
Subject status	Elective	Online percentage	0%

Subject description

Subject goals	After completing the course, students are expected to know the basics of the concepts of observational astronomy, principles of operation and types of telescopes, detectors, advanced observation techniques, and photometry and spectroscopy.
Enrolment requirements	Attended the course Astrophysics I (PMP131).
Learning outcomes	After mastering the material, the student is expected to know: 1. Basic concepts related to the position of celestial objects in the sky and coordinate systems in use 2. Working principle and types of telescopes 3. Advanced observational techniques, such as adaptive optics and interferometry 4. Types and principle of detector operation in astronomy 5. Photometric systems and measurement techniques 6. Basic techniques in astronomical spectroscopy
Syllabus	1. Celestial sphere, position of celestial objects, coordinate systems and transformations, astrometry 2. Telescopes: working principle, design and types of telescopes, power of resolution, magnification, optical errors; optical, radio, X-ray, Cherenkov telescopes 3. Diffraction of light, turbulence in the atmosphere, Point Spread Function (PSF), seeing, Strehl ratio, principle of adaptive optics 4. Interferometry 5. Space missions and satellites, sky surveys 6. Detectors (CCD and other types of detectors in the infrared, radio, X-ray part of the spectrum) 7. Digital images in astronomy, FITS format 8. Basics of photometry (photometric systems, photometric standard and calibration, apertures and PSF photometry, Poisson statistics, signal-to-noise ratio) 9. Basics of spectroscopy (light dispersion, dispersive optical elements, types of spectrometers, spectral resolution, interpretation of stellar spectra)
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Attend at least 70% of lectures and exercises.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums	1	Oral exam	1		
Written exam	1	Project			

Assessment and evaluation of student work	The final grade will constitute of: (1) Written exam or tests (40%) (2) Oral exam (40%) (3) Seminar (20%)

Required literature

Title	Number of copies available	Availability on other medium
C. R. Kitchin, „Astrophysical Techniques", CRC Press (2013)		

Supplementary literature	G. H. Rieke, "Measuring the Universe: A Multiwavelength Perspective", Cambridge University Press (2017)
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the

	end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">General Physics</td></tr>
<tr><td>ID</td><td>PMP090</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Željana Bonačić Lošić</td><td>Points value (ECTS)</td><td>4.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Enable acquiring knowledge and student competences in general physics that are useful for further studies and application in their area of expertise.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Student should be able to :
1. correctly state and apply the basic concepts of general physics.
2. correctly state and apply the basic laws of general physics.
3. apply the acquired knowledge to solve simple problems in general physics.
4. apply the acquired knowledge in chemistry and biology.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Introduction. Measurements. (2h)
2. Motion in one, two and three dimensions. (2h)
3. Laws of motion. Kinetic energy and work. (2h)
4. Potential energy and conservation of energy. Many particle systems. (2h)
5. Rotational motion. Gravity. Solids and fluids. (2h)
6. Oscillations and waves. sound waves. (2h)
7. Temperature, heat and the first law of thermodynamics. (2h)
8. Entropy and the second law of thermodynamics. (2h)
9. Electric charge. Electric field and potential. (2h)
10. Electric currents and resistance. (2h)
11. Magnetic field. Maxwell equations. (2h)
12. Electromagnetic oscillations and alternating current. Electromagnetic waves. (2h)
13. Optics. Wave optics. Relativity. (2h)
14. Photons. Matter waves Physics of atom. Laser. Solid state. (2h)
15. Nucleus. Radioactivity. Biological systems. (2h)
Solving problems numerically, introduction to measurements, and measurements of selected physical properties.</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Lectures with interactive simulations and experiments. Solving problems instructed by assistant. Uninfluenced solving of problems.
Active lectures and exercises attendance.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1.5; Research; Practical work
Experimental work; Paper
Essay; Seminar paper
Colloquiums; Oral exam: 1.5
Written exam: 1.0; Project</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Preliminary exams. Written exam. Oral exams.</td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
M. Dželalija, Opća fizika s primjerima fizike bioloških sustava (u pripremi), Sveučilište u Splitu, 2005. | | </td></tr>
<tr><td>Supplementary literature</td><td colspan="3">R. A. Serway, J. S. Faughn, College Physics, Fifth Edition, Saunders College Publishing, Orlando, 2000. Earth Systems, Processes and Issues, ed. by W.G. Ernst, Cambridge University Press, 1999.</td></tr>
</table>

Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

Subject name	General Relativity and Cosmology		
ID	PMP400	Study year	2.
Lecturer	doc. dr. sc. Zvonimir Vlah	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description

Subject goals	The first part of the course will cover the basics of general relativity, its mathematical foundations: Special Relativity; Manifolds, Riemannian metric, connection, curvature; Equivalence principle; Energy-momentum tensor, field equations, Newtonian limit; Post-Newtonian approximation; Schwarzschild solution; Black holes, Gravitational waves. The second part will cover the following topics; FLRW metric and homogeneous cosmology; Thermal history of the universe; Dark matter and Dark Energy; Cosmic microwave background; Structure formation.
Enrolment requirements	Students should have good grasp of material typpically covered in courses: - Classical electrodynamics - Mathematical Methods in Physics - Special Theory of Relativity
Learning outcomes	On successful completion of this course, students should: - have good understanding of the Special Relativity - be familiar with the geometrical representation of General Relativity and its link to Newtonian gravity - basic understanding the black hole solutions in General Relativity, and be familiar with the gravitational waves and its origins within the scope of General Relativity - grasp the basic picture of the homogeneous cosmology and evolution of the Universe
Syllabus	Short Review of Special Theory of Relativity Introduction and the Geometric Viewpoint on Physics Gravity and Einstein's Equations Schwarzschild Solution and Black Holes Perturbation theory and Newtonian limit Gravitational waves Cosmology and FLRW metric History and evolution of the universe CMB and the structure formation in the universe
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☑ Fully online ☑ Combined online ☐ Fieldwork ☐ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring ☑ homework assignments ☐ ☐ ☐
Student obligations	Students should: - participate and follow the lectures and exercises (at least 70%) - work through the assigned material and lecture notes - work on homework assignments - actively participate in the interactive part of the lectures

Monitoring student work

Class attendance		Research		Practical work	
Experimental work		Paper		Homework assignments	3
Essay		Seminar paper			
Colloquiums		Oral exam	3		
Written exam		Project			

Assessment and evaluation of student work	The examination consists of two parts: - homework assignments: 50% - final oral examination: 50%

Required literature

Title	Number of copies available	Availability on other medium
S. Carroll - Spacetime and Geometry: An Introduction to		

	General Relativity		
Supplementary literature	R. Wald – General Relativity S. Weinberg – Gravitation and Cosmology A. Zee – Einstein Gravity in a Nutshell B. Schutz – A first course in General Relativity,		
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Opća zoologija						
ID	PMB013	Study year	1.				
Lecturer	prof. dr. sc. Biljana Apostolska	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	45	0	
Subject status	Compulsory	Online percentage	10%				
Subject description							
Subject goals	usvojiti znanja i pojmove koji su bitni za razumijevanje morfologije, sistematike, filogenije i evolucije životinja. - upoznavanje i komparacija različitih organskih sustava te njihovog razvoja kod različitih životinjskih skupina. - prepoznavanje tipova tkiva i organa pod mikroskopom i uvid u rani embrionalni razvoj životinja. - znanje stečeno na predavanjima omogućit će studentima lakše praćenje i razumijevanje ostalih biologijskih i drugih predmeta na višim godinama studija.						
Enrolment requirements	Nema ih						
Learning outcomes	Studenti će nakon završetka odslušanja predmeta moći: 1.objasniti sistematiku i taksonomiju životinjskog carstva 2.koristiti latinsko nazivlje i binarnu nomenklaturu 3.opisati osnovne razlike u građi organskih sustava po skupinama 4.protumačiti vezu između građe organa i načina života životinja 5.definirati i koristiti osnovne zoološke pojmove 6.ovladati radom na mikroskopu 7.usvojiti i primijeniti vještine rada laboratorijskim priborom 8.postići samostalnost u laboratorijskom radu						
Syllabus	Predavanja 1.Zoologija kao znanost i njena područja, pregled razvitka zoologije, funkcionalne i strukturne osobine životinjskih organizama, osnovna načela anatomije i morfologije životinja, promorfologija - plan građe tijela životinja, broj životinjskih vrsta, izumiranje vrsta. (2 sata) 2.Evolucija, Darwin i Wallace, dokazi evolucije, evolucijski mehanizmi, mikroevolucija, makroevolucija, varijabilnost, populacija, vrsta, izolacijski mehanizmi, specijacija, rezultat evolucije, sistematika, taksonomija, osnovna načela klasifikacije životinja, filogenija, zoologijska nomenklatura, Linne, kladistika, osnovna metodološka načela u zoologijskim istraživanjima. (2 sata) 3.Prokarioti i Eukarioti, domene i carstva, stanična evolucija, endosimbiontska teorija, evolucija mnogostaničnih organizama, karakteristike i teorije postanka Metazoa, tjelesne šupljine i zametni listići. (2 sata) 4.Epitelna tkiva, vrste epitela, strukturne i funkcionalne karakteristike pokrovnog i žljezdanog epitela,vezivno tkivo, karakteristike mezenhima, strukturne karakteristike vezivnog tkiva: stanice, vlakna i osnovna tvar, masno tkivo, hrskavica i koštano tkivo (2 sata) 5.5.Mišićno tkivo, strukturne i funkcionalne karakteristike glatkog, poprečno-prugastog i srčanog mišićnog tkiva, Živčano tkivo: neuroni, neuroglija, živčana vlakna i mijelinizacija, prijenos impulsa, sinapsa. (2 sata) 6.Pregled životinjskog svijeta: Protozoa, Metazoa, Ameria, Polymeria, Oligomeria, Tunicata, Cephalochordata, Cyclostomata, Chondrichthyes, Osteichtyes, Amphibia, Reptilia, Aves, Mammalia. (2 sata) 7.Građa i funkcija organa i organskih sustava u životinja i njihov razvoj, strukturalna i funkcionalna evolucija osnovnih organskih sustava, Kožni ili integumentni sustav: uloga, dvoslojna lipoproteinska membrana, pelikula, epiderm, žlijezde, kutikula, obojenost, rožnate tvorbe. (2 sata) 8.Potporni ili skeletni sustav: hidroskelet, čvrsti skelet: egzo i endoskelet, složeno građen kostur, Mišićni ili muskularni sustav: načini pokretanja životinja, citoskelet, ameboidno kretanje, trepetljike i bičevi, mišićno tkivo, 9.Živčani ili nervni sustav: pregled živčanog sustava u životinja (mrežasti, ljestvičav, centralizacija,središnji i periferni živčani sustav) Osjetni ili receptorni sustav: osjetne i potporne stanice, osjetila u praživotinja i u mnogostaničnih životinja, egzoreceptori, proprioreceptori, mehanoreceptori, kemoreceptori, fotoreceptori, termoreceptori. (2 sata) 10.Dišni ili respiratorni sustav: anaerobno i aerobno disanje, disanje pomoću: površine tijela, škrga(vanjske i unutrašnje), uzdušnica, pluća (razvoj pluća), disanje ptica. (2 sata) 11.Optjecajni ili cirkulacijski sustav: uloga, tjelesne tekućine: hidrolimfa, celomska						

	tekućina, krv i limfa, respiratorni pigmenti, otvoren i zatvoren optjecajni sustav, mali i veliki optok, krvožilni i limfni sustav. (2 sata) 12.Probavni ili digestivni sustav: autotrofni i heterotrofni organizmi, podjele s obzirom na vrstu i veličinu hrane, načini uzimanja hrane, probava: intracelularna i ekstracelularna, oblici probavnog sustava u životinja, neprohodno i prohodno probavilo. (2 sata) 13.Izmetni ili ekskrecijski sustav: amoniotelične, ureotelične i urikotelične životinje, oblici izmetnog sustava: površina tijela, stežljivi mjehurići, oblici i način rada nefridija, antenalne, maksilarne i kučne žlijezde, Malphigijeve cjevčice, bubrežni sustav: prvi, drugi i treći bubreg, nefron. (2 sata) 14.Rasplodni ili reprodukcijski sustav: nespolno razmnožavanje (binarna i mnogostruka dioba, plazmotomija, pupanje), regeneracija, autotomija; spolno razmnožavanje (oblici spolnog razmnožavanja, rasplodni sustav, građa organa za rasplod, gonohorističke i hermafroditske životinje,vanjska i unutrašnja oplodnja, partenogeneza, oblici rasplodnog sustava u životinja, spermatofori, oblici jaja, embrionalni i postembrionalni razvoj, izmjena generacija, razmnožavanje životinja i određivanje spola). (2 sata) 15.Hormonalni ili endokrini sustav: hormoni, neurohormoni i žljezdani hormoni, hormonalna djelatnostu beskralješnjaka i kralješnjaka. (2 sata) Vježbe 1.Mikroskop i mikroskopiranje (3 sata) 2.Promorfologija I (3 sata) 3.Promorfologija II (3 sata) 4.Kožni sustav (3 sata) 5.Potporni sustav . (3 sata) 6.Mišićni sustav (3 sata) 7.Živčani sustav (3 sata) 8.Osjetila (3 sata) 9.Probavni sustav (3 sata) 10.Dišni sustav (3 sata) 11.Optjecajni sustav (3 sata) 12.Ekskretorni sustav (3 sata) 13.Spolni sustav (3 sata) 14.Embrionalni razvoj (3 sata) 15.Postembrionalni razvoj (3 sata)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☑ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	prisustvovanje predavanjima, praktičnoj nastavi i terenskoj nastavi

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums	2	Oral exam	1		
Written exam	1	Project			

Assessment and evaluation of student work	Ispit se sastoji od pismenog i usmenog dijela. Gradivo predmeta podijeljeno je na dvije cjeline koje studenti polažu preko parcijalnih pismenih ispita ili pak pristupanjem cjelokupnom ispitu na kraju semestra. Pismeni ispit se smatra položenim ukoliko studenti postignu najmanje 60% od ukupnog broja bodova. Nakon položenog pismenog dijela student stiče pravo izlaska na usmeni dio ispita. Konačna ocjena formira se temeljem ocjena iz pismenog i usmenog dijela ispita. Bodovanje: <60% student nije zadovoljio; 60-70% dovoljan (2); 70-80% dobar (3); 80-90% vrlo dobar (4); 90-100% izvrstan (5).

Required literature

Title	Number of copies available	Availability on other medium
Matoničkin, I., Erben, R. (2002): Opća zoologija. Školska knjiga, Zagreb.		
I., Erben, R., Habdija, I. (1983): Praktikum iz opće		

	zoologije. Sveučilište u Zagrebu, Zagreb		
Supplementary literature	Miller, S.A., Harley, J.P. (2004): Zoology. McGraw-Hill, Boston. Hickman, C. Jr., Roberts, L., Larson, A., I'Anson, H. (2003): Integrated Principles of Zoology.McGraw-Hill, Boston. Wheater's Functional Histology: a text and colour atlas, ed. B. Young, J.W. Heath, Churchill Livingstone, London, 2001		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

Subject name	Operating Systems						
ID	PMID70	Study year	1.				
Lecturer	doc. dr. sc. Goran Zaharija	Points value (ECTS)	5.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	30	0	
Subject status	Elective	Online percentage	0%				
Subject description							
Subject goals	Develop an understanding of the role of the operating system in the computer system that can be accomplished management resources to the best use of computing resources and create an environment for preparing and implementing the program.						
Enrolment requirements	Admission requirements: none. Entry competences: basic knowledge of computer.						
Learning outcomes	Students will be able to: 1. Explain the mechanisms of transmission of data between external units and systems 2. Understand and apply the synchronization mechanisms 3. Explain procedures management The storage space 4. Explanation of the functions and use the file system 5. Advanced use operating system UNIX 6. Develop and test multi-threaded programs						
Syllabus	Introduction to the subject. The role of the operating system in the computer system. The hierarchical structure, historical development and the parts of the operating system. Exercises: Introduction to the exercise. Introduction to UNIX. Check-in and check-out operation. Model simple PC on which to base the study of the operating system. The role of the processor, tanks and outdoor units in the computer. The task, process and instructional threads. Changing context. Exercises: user directory. Working with directories and files. Input-output operations. Interrupt data transfer. Data transfer by direct memory access. Hardware for managing multiple breaks with priorities. Exercise: Balance system. Users. Viewing process. Setting process. The realization of tasks based on the multithreaded execution. The relationship between threads. Mutual exclusion two threads. Procedures Dekker and Peterson. Exercise: Redirecting standard input, standard output and output for errors. Chaining commands. Mutual exclusion larger number of threads. Lamport's protocol. Mutual exclusion is based in the control support. Exercise: Manage permissions. Links to the files. The structure of the data center. The descriptor for this thread and this thread transition state. Nuclear features of the monitor, binary and general traffic light. Exercises: Colloquium first Input-output operations and delay. Instant messaging between processes across an unlimited and limited tank and message queue. Exercises: The screen editor Vi. Swap files. Synchronize threads. Necessary conditions deadlock. Strategy in relation to a complete standstill. Problem five philosophers. Hoareov concept monitor. Exercises: Shell Programming: Writing and executing shell file. Basic commands. Time series analysis of computer systems. Basic models of stochastic models of tasks. Exercises: Shell Programming: Branching instructions. System analysis of the Poisson distribution of arrivals tasks and exponential distribution of their treatment. Types serving tasks. Exercises: Shell Programming: repetition statements. Preparation program for execution. The physical and logical address space. Assigning storage tank farm. Disc features like auxiliary tank. The problem of fragmentation. Exercise: Regular expressions. Virtual memory paging mechanism based on. Hardware support for paging. Exercises: Colloquium second						

<table>
<tr><td></td><td colspan="3">Paging on demand. Strategy replacement page.
Exercises: Multithreaded Programming: Console applications.
File system. The descriptor file. The descriptor storage tank farm. The functions of the file system.
Exercises: Multithreaded Programming Windows applications.
Study of typical operating systems: Linux and Windows.
Exercises: Colloquium third</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☑ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Lecture 70%, exercise attendance 70%, 3 colloquia, practical and oral examination. Students who are successful in the preliminary exams are released practical exam</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical work</td><td>2</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1.5</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Activity of students in exercises (presence, addressing the challenges of homework) (10%).
Practical exam (60%). During the semester are held three preliminary exams (25% + 25% + 10%). The student is successful in a colloquium if achieved half of the expected number of points, but in this case, released a practical exam.
Oral exam (30%) is compulsory for all students, while answering three questions randomly selected from a list of 50 questions divided into three categories.
The final grade is derived on the basis of all these ratings with weighting factors as indicated in parentheses for each form of assessment.</td></tr>
<tr><td>Required literature</td><td colspan="3"><table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>1. Budin, L., Golub, M., Jakobović, D., Jelenković, L.: Operacijski sustavi, Element, Zagreb, 2010. (16 primjeraka u knjižnici).</td><td>16</td><td></td></tr>
<tr><td>2. M. Žagar: UNIX i kako ga koristiti, Sveučilište u Zagrebu, Fakultet elektrotehnike i računarstva, 2007 (1. internetsko izdanje)</td><td></td><td>da</td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3">Talk with students, student evaluation using the anonymous survey, the success of students in the exam, self-assessment.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Optimization		
ID	PMM922	Study year	1.
Lecturer	prof. dr. sc. Milica Klaričić Bakula	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 0, P: 0
Subject status	Compulsory	Online percentage	30%

Subject description

Subject goals	Optimization is the art of optimal decision making under constraints. Convex optimization refers to a set of problems that can be formulated using convex functions and sets; countless problems from science, engineering and statistics can be cast as convex optimization problems and solved using efficient algorithms. The main goal of this course is to develop the skills and background needed to recognize, formulate and solve convex optimization problems. The course is intended as an introduction to convex optimization, focusing on the theory, the modelling techniques, and the algorithm analysis and design.
Enrolment requirements	Entry competences: Linear algebra. Numerical linear algebra (basics).
Learning outcomes	Upon successful completion of this course students will be able to: – recognize and formulate convex optimization problems as they arise in practice – know a range of algorithms for solving linear, quadratic and geometric programming problems, and evaluate their performance – understand the theoretical foundations and be able to use it to characterize optimal solutions to optimization problems – appreciate the role of convex optimization in approximation and fitting, statistic and geometry.
Syllabus	– Overview and examples of optimization problems (2) – Convex sets (2) – Convex functions (2) – Convex optimization problems (4) – Duality (4) – Unconstrained minimization (6) – Equality constrained minimization (2) – Interior-point methods (4) – Applications (4)
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring
Student obligations	Attending classes, doing homework assignments. Writing and presenting seminars.

Monitoring student work

Class attendance	2	Research		Practical work	0.5
Experimental work		Paper			
Essay		Seminar paper	0.5		
Colloquiums	2	Oral exam			
Written exam		Project			

Assessment and evaluation of student work

Seminars will be evaluated throughout the semester. Final oral exam.

Continuous assessment

Evaluation elements	Performance (min)	Weight in grade (%)
partial written exams	50	80
solving problems with Matlab	100	20

Final assessment

Evaluation elements	Performance (min)	Weight in grade (%)
final exam	50	80

<table>
<tr><td rowspan="2">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>S. Boyd and L. Vandenberghe, Convex Optimization, Cambridge University Press, 2004</td><td></td><td>e-learning</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">1. J. Nocedal and S.J.Wright, Numerical Optimization, Springer, 2006.
2. A. Ben-Tal and A. Nemirovski. Lectures on Modern Convex Optimization. 2013.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Summary feedback for the whole class after the exam.
Anonymous student survey.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Organic Chemistry		
ID	PMC222	Study year	2.
Lecturer	izv. prof. dr. sc. Renata Odžak	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 45, P: 0
Subject status	Compulsory	Online percentage	20%

Subject description	
Subject goals	Knowledge of basic groups of organic compounds, their structure, terminology, physical properties, preparation and chemical reactions.
Enrolment requirements	Completed course General and Inorganic Chemistry.
Learning outcomes	After completing the course, the students will be able to: 1.Classify organic compounds according to functional groups. 2. Know the name of organic compounds based on the structural formula and predict the structural formula from the name of the compound. 3. Distinguish and explain different types of isomerism. 4. List and compare the main types of organic reactions. 5. Analyze the reactivity and physical properties of organic compounds with respect to their structure. 6. Distinguish and compare the reaction mechanisms of substitution, addition and elimination. 7. Explain the chemical reactions characteristic of a particular group of compounds. 8. List and explain the usual techniques for purification of organic compounds and independently perform laboratory exercises according to regulations.
Syllabus	Lectures and seminar 1. Introduction to organic chemistry; sp3, sp2 and sp hybridization; resonant structure structures; acids and bases 2. Alkanes: structural formulas, terminology, isomerism, physical properties, conformers, chemical properties. 3. Cyclic compounds: cyclopropane, cyclobutane, cyclopentane, cyclohexane, cyclohexane derivatives, conformers. 4. Alkenes, alkynes: structural formulas, terminology, isomerism, physical properties, chemical properties; electrophilic addition. 5. Stereoisomers: enantiomers, diastereoisomers, determination of relative and absolute configuration, polarimeter. 6. Haloalkanes: nucleophilic substitution SN2, elimination E2, nucleophilic substitution SN1, elimination E1. 7. Alcohols, ethers: structural formulas, terminology, physical properties, chemical properties. 8. Amines: classification, structure, nomenclature, physical and chemical properties, alkaloids. 9. Aldehydes and ketones: structural formulas, terminology, physical properties, chemical properties – nucleophilic addition. Synthesis of hemiacetals and acetals, respectively poluketals and ketals. 10. Carboxylic acids: structural formulas, terminology, physical and chemical properties. 11. Derivatives of carboxylic acids: esters, amides, anhydrides, acyl halides, nitriles – chemical structure, nomenclature, hydrolysis. Fatty acids, fats, oils. 12. Organometallic reagents, Grignard reagent, chemical properties. 13. Aromatic compounds: benzene, electrophilic aromatic substitution. 14. Amino acids: structural formulas, division by properties, peptide bond – synthesis and hydrolysis. Proteins. 15. Carbohydrates: monosaccharides – glucose, fructose, disaccharides, glycosidic bond, polysaccharides – starch cellulose, glycogen. Seminars follow the topics of the lecture, with a minimum of one lesson for each topic. Laboratory exercises: 1. Properties of organic compounds. 2. Purification techniques in organic chemistry (chromatography, extraction, recrystallization). 3. Characteristic reactions of functional groups.

	4. Identification of organic compounds by determination of melting point. 5. Synthesis of organic compounds (oxidation and reduction reactions, esterification, substitution and elimination reactions). 6. Isolation of compounds from natural materials (caffeine, oleic acid, lactose).					
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online		☐ Fieldwork ☐ Individual assignments ☑ Multimedia ☑ Laboratory ☐ Mentoring		☐ ☐ ☐ ☐	
Student obligations						
Monitoring student work	Class attendance	0.5	Research		Practical work	
	Experimental work	1.5	Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam	2		
	Written exam	2	Project			
Assessment and evaluation of student work	For the passing grade, it is necessary to solve 50% of each partial exam. Passing grade on a written exam is a condition for passing an oral part of an exam.					
Required literature	Title				Number of copies available	Availability on other medium
	J. McMurry, Osnove organske kemije, Medicinski fakultet Sveučilišta u Rijeci i Zrinski dd, 2014.					
	P. Y. Bruice, Essential Organic Chemistry, Pearson Education International, 2006.					
	Interna skripta za vježbe (Odžak), 2020.					
Supplementary literature	W. H. Brown, Introduction to Organic Chemistry, 2nd Ed., Saunders College Publishing, 2000.					
Quality assurance	Consultations, partial exams, student survey for the evaluation of subjects and teachers, records of attendance at lectures, analysis of the success of exams.					
Other (in the opinion of the proponent)						

Subject name	Organic Chemistry I		
ID	PMC005	Study year	2.
Lecturer	izv. prof. dr. sc. Stjepan Orhanović	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 45, S: 15, E: 0, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description	
Subject goals	Course objective is acquiring knowledge about basic groups of organic compounds, their structure, nomenclature, physical properties, synthesis and reactivity
Enrolment requirements	Enrolment requirement is completed exam General chemistry I and competences acquired upon taking course General chemistry II.
Learning outcomes	Upon completing exam student will be able to: 1.describe organic compounds in relation to their functional groups 2.give proper name to organic compounds following IUPAC recommendations 3.describe physical and chemical properties of organic compounds in every group 4.present and describe reaction mechanism of reactions characteristic for specific class of compounds 5.distinguish organic compounds isomers
Syllabus	Lectures: 1.Introduction to organic chemistry 83 hours) 2.Hybridisation: sp3, sp2, sp, resonant structures (3 hours) 3.Alkanes: structural formulas, nomenclature, isomery, physical properties (3 hours) 4.Alkanes: conformers, chemical properties – halogenation, oxidation (3 hours) 5.Stereoisomers: enantiomers, diastereomeres, determination of relative configuration, determination of absolute configuration (3 hours) 6.Alkyl halides: nucleophilic substitution SN2, elimination E2 (3 hours) 7.Alkyl halides: nucleophilic substitution SN1, elimination E1 (3 hours) 8.Alkenes, alkynes: structural formulas, nomenclature, isomery, physical properties, chemical properties (3 hours) 9.Electrophilic addition (3 hours) 10.Alcohols, ethers: structural formulas, nomenclature, physical properties, chemical properties (3 hours) 11.Tiols, sulphides: structural formulas, nomenclature, physical properties, chemical properties (3 hours) 12.Aldehydes and ketones: structural formulas, nomenclature, physical properties, chemical properties – nucleophilic addition (3 hours) 13.Synthesis of acetals, hemiacetals, ketals, hemiketals, imines, Schiff bases, diols (3 hours) 14.Carboxylic acids: structural formulas, nomenclature, physical properties, chemical properties – acidity, esterification (3 hours) Seminars follow lecture subjects with one hour for every lecture
Teaching types	[x] Lectures [x] Seminars [ ] Exercises [ ] Fully online [ ] Combined online [ ] Fieldwork [ ] Individual assignments [ ] Multimedia [ ] Laboratory [ ] Mentoring [ ] [ ] [ ] [ ]
Student obligations	Attending classes and seminars, at least 70 % of terms

Monitoring student work						
Class attendance	2.0	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	1.5	Oral exam	2.5		
Written exam		Project			

Assessment and evaluation of student work	Before every lecture quiz is being held on the previous lecture subject, student that accomplishes more than 50 % of the total points gains one grade higher on the respectable partial written exam. Passing grade requires at least 50 % points on partial exams. Passing grade on the written exam is condition for attending oral exam.

<table>
<tr><td rowspan="2">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>S.H. Pine, J.B. Hendrickson, D.J. Cram, G.S. Hammond; Organska kemija, Školska knjiga, Zagreb 1994.</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Andrew Streitwieser, Clayton H. Heathcock, Edward M. Kosower: Introduction to Organic Chemistry, Prentice Hall, Inc. 1992.
D. Klein: Organic Chemistry, John Wiley and Sons, Inc. 2012.
Maja Pavela-Vrančić, Organska kemija, powerpoint prezentacija</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Personal consultations, completing partial exams, students survey for the evaluation of the subject and teacher, evidence of the presence on the classes, analysis of the success rate on the quizzes, partial and final tests.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Fundamentals of Astronomy and Astrophysics		
ID	PMP130	Study year	1.
Lecturer	doc. dr. sc. Marko Kovač	Points value (ECTS)	3.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 0, P: 0
Subject status	Elective	Online percentage	30%

Subject description

Subject goals	Introduce students to the basic concepts of astronomy and astrophysics.
Enrolment requirements	Mechanics (attended)
Learning outcomes	1. Define the units and describe and analyze the methods of measuring distance in astronomy. 2. Define the coordinate systems for orientation in the celestial sphere, describe phenomena related to the rotation and revolution of the Earth (apparent motion of planets, eclipses, changing of seasons, sidereal and synodic period, precession of the Earth). 3. Analyze the principle of operation and structure of observational instruments and detectors, explain the basic observational techniques in astronomy across the entire electromagnetic spectrum. 4. Describe the physical and dynamic characteristics of objects in the Solar System (planets, their satellites, comets, and asteroids) and the formation of planets and planetary systems. 5. Describe the classification of stellar spectra, the physical characteristics of stars and the Sun, and analyze the Hertzsprung-Russell diagram. 6. Identify the basic relationships in the structure of stars and describe the mechanism of pulsation in variable stars. 7. Analyze the internal structure, sources, and transfer of energy in stars, and apply them to the evolution of stars, stellar populations, and stellar clusters. 8. Describe the space radiation and possibilities for its detection, define apparent and absolute brightness, luminosity, radiation intensity. 9. Morphologically classify galaxies and describe the properties and structure of elliptical and spiral galaxies, the Milky Way, and galaxy clusters. 10. Describe the theory of the Big Bang, cosmic microwave background radiation, and analyze observations of the expanding universe.
Syllabus	1. (2+1) Astrognosis 2. (2+1) Historical development of astronomy and astrophysics, 1/2 3. (2+1) Historical development of astronomy and astrophysics, 2/2 4. (2+1) Motion of Earth and phenomena on the celestial sphere 5. (2+1) Celestial mechanics 6. (2+1) Astronomical instruments 7. (2+1) Photometry 8. (2+1) Earth and Moon 9. (2+1) Physics of stars, 1/3 10. (2+1) Physics of stars, 2/3 11. (2+1) Physics of stars, 3/3 12. (2+1) Interstellar matter 13. (2+1) Galaxies 14. (2+1) Special and general theory of relativity 15. (2+1) Cosmic evolution and cosmology
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	

Monitoring student work

Class attendance	1.5	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	0.5		
Colloquiums		Oral exam	1		
Written exam		Project			

<table>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Twice during the semester, students take a written exam covering two halves of the material. Students who score more than 50% on each exam are exempt from taking the written exam and can proceed to the oral exam. Students who score 50% or more on the first written quiz can take the oral exam in two parts, immediately after the written exam is graded. The final grade is based on the written exam (worth 1/2 of the grade) and the performance on the oral exam (worth 1/2 of the grade).</td></tr>
<tr><td rowspan="3">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>V. Vujnović, Astronomija I, Školska knjiga Zagreb, 1993.</td><td>3</td><td>no</td></tr>
<tr><td>V. Vujnović, Astronomija II, Školska knjiga Zagreb, 1994.</td><td>2</td><td>no</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Slides and lecture notes.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">1. Teachers who have correlated learning outcomes collaborate and jointly ensure the quality of teaching.
2. Statistical analysis of exam results and evaluation of success in accordance with the stated learning outcomes.
3. Student evaluation through an anonymous survey conducted in accordance with the regulations of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Bioinformatics basics						
ID	PMC224	Study year	2.				
Lecturer	izv. prof. dr. sc. Stjepan Orhanović	Points value (ECTS)	4.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			15	15	15	0	
Subject status	Compulsory	Online percentage	30%				

Subject description

Subject goals	The aim of the Bioinformatics course is to familiarize students with data (sequences and structural information) generated by experimental work in the fields of biochemistry and molecular biology, their storage in databases and the possibilities of processing this data with bioinformatics tools
Enrolment requirements	Biochemistry I course taken, basic knowledge of the structure and sequence of DNA and proteins is required.
Learning outcomes	After passing the exam, the student will be able to: Search relevant databases: scientific publications, sequences of nucleic acids and proteins and the structure of biological macromolecules Analyze DNA, RNA and protein sequences Analyze protein structure Identify the role and potentials of bioinformatics in the development of medicines Identify ways of genome analysis and analysis of gene sequence, phenotype and inherited diseases
Syllabus	Lectures in bioinformatics will be followed by exercises in the IT classroom after which students will present their seminar papers. 30% of classes will be prepared as e-learning using online sources. 1. Scientific literature and basics of searching scientific publications (1 hour of lectures and 1 hour of exercise,) 2. Databases of nucleic acid sequences (1 hour lecture and 1 hour of exercise) 3. Protein sequence databases (1 hour lecture and 1 hour of exercise) 4. Alignment of sequences and phylogenetic trees (1 hour lecture and 1 hour of exercise, 1 hour of seminar) 5. Seminar, search and analysis of scientific publications and sequences I (2 hours) 6. Seminar, search and analysis of scientific publications and sequences II (2 hours) 7. Protein structure databases I (1 hour lecture and 1 hour of exercise) 8. Protein Structure Databases II (1 hour lecture and 1 hour of exercise) 9. Seminar, analysis of protein structures (2 hours) 10. Databases of sequenced genomes (1 hour lecture and 1 hour of exercise) 11. Seminar sequences and genome analysis (2 hours) 12. Structural bioinformatics and drug discovery (1 hour lecture and 1 hour of exercise) 13. Getting acquainted with DNA microarray data and using mass spectrometry in protein sequencing I (1 hour lecture and 1 hour of exercise) 14. Getting acquainted with DNA microarray data and using mass spectrometry in protein sequencing II (1 hour lecture and 1 hour of exercise)

Teaching types			
	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☑ Combined online	☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐
Student obligations			

Monitoring student work						
	Class attendance	1.5	Research		Practical work	
	Experimental work		Paper		Priprema za ispit	0.7
	Essay		Seminar paper	0.7		
	Colloquiums		Oral exam			
	Written exam	0.1	Project			

Assessment and evaluation of student work	Students take a written exam, for a passing grade it is necessary to solve 50% of the exam. Seminar papers are evaluated comprising an overall score of 50%, the other 50% is

<table>
<tr><td></td><td colspan="3">the grade of the written part of the exam.</td></tr>
<tr><td rowspan="2">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Arthur M. Lesk, Introduction to bioinformatics 3e, Oxford University Press, 2008</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">David W. Mount, Bioinformatics, Sequence and Genome analysis, 2e, Cold Spring Harbor Laboratory Press, 2004
Jonathan Pevsner, Bioinformatics and Functional Genomics, John Wiley and Sons, 2009</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Personal consultations, students survey for the evaluation of the subject and teacher, evidence of the presence on the classes, analysis of the success rate on the partial and final tests.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Basic algebraic structures						
ID	PMM715	Study year	1.				
Lecturer	doc. dr. sc. Gordan Radobolja	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	30	0	
Subject status	Elective	Online percentage	0%				
Subject description							
Subject goals	Adopt basics of commutative rings theory, arithemtic of polynomials and solvability of algebraic equations.						
Enrolment requirements	Prerequisites: completed courses Introduction to Algebra with Analytic Geometry or Linear algebra and Matrix Calculus Required competencies: knowledge of fundamentals of linear algebra and elementary mathematics.						
Learning outcomes	It is expected that the student will be able to: – Geometrically interpet complex numbers, roots of unity and operations with them – Distinguish between a formal polynomial and a polynomial function, between root and a zero-point – State basic definitions and theorems in theory of commutative rings – State, prove and apply the fundamental theorem of arithmetics for polynomials (check reducibility of and factorise a rational polynomial) – Apply Euclidean algorithm – Solve cubics and quartics – Explain the concepts of splitting fields, Galois group and solvability in radicals – Distinguish algebraic and transcendental numbers, and algebraically closed and open fields						
Syllabus	Classical algebra (4 hours) Elementary number theory. Pythagorean triples, fundamental theorem of arithmetic. Number systems. Complex numbers. Roots of unity. Commutative rings (6 hours) Basics Domains and rings of fractions Polynomial ring and polynomial functions Homomorphisms Arithmetic of polynomials (8 hours) Divisibility Roots Factorisation Irreducibility and criteria. Cyclotomic polynomials Field theory (8 hours) Quotient ring Field extensions Algebraic extensions Splitting fields Solvability in radicals (4 hours) Groups Radical extensions Galois theory Insolvability of the quintic						
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐				
Student obligations	Class attendance and partial written exams.						

Monitoring student work	Class attendance	2	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums	2	Oral exam	2		
	Written exam		Project			
Assessment and evaluation of student work	Partial written exams and final written and oral exam. Positive grade of the written exam is required to take the oral exam.					

Required literature	Title	Number of copies available	Availability on other medium
	A. Cuoco, J. J. Rotman, Learning modern algebra		

Supplementary literature	D.S. Dummit, R.M. Foote, Abstract Algebra, treće izdanje, John Wiley and Sons, 2004.
Quality assurance	Anonymous student evaluations at the end of semester according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Partial Differential Equations		
ID	PMM915	Study year	1.
Lecturer	prof. dr. sc. Saša Krešić Jurić	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description

Subject goals	The course objective is to introduce students to the theory of partial differential equations (PDE) and to teach them basic techniques for finding their solutions. The emphasis is on understanding the theoretical results as well as developing practical skills for problem solving.
Enrolment requirements	Prerequisites: completed courses Differential and Integral Calculus 1 and 2 (or Mathematics 1 and 2), Linear Algebra (or Linear Algebra and Matrix Calculus) and Ordinary Differential Equations (or Differential Equations) Required competences: knowledge of differential and integral calculus in one and two varibles, matrix calculus and ordinary differential equations
Learning outcomes	It is expected that the student will be able to: find Fourier series of a given function, classify second order linear PDEs in two variables, formulate stability problems of PDEs for different types of inital and boundary conditions, find solutions of the heat equation and wave equation by the method of separation of variables, find D'Alambert's solution of the wave equation, find solutions of the Laplace and Poisson equations by the method of separation of varibles for rectangular and circular domains. It is also expected that the student is able to prove the theorems used in the development of the theory of PDEs.
Syllabus	Introduction and elementary techniques (2 hours) Initial and boundary conditions, stability of solutions (2 hours) Fourier series (2 hours) Dirichlet's theorem, uniform convergence (2 hours) Classification of second order equatins (2 hours) Canonical forms of hyperbolic, parabolic and elliptic equations (2 hours) The maximum principle for the heat equation, the uniqueness theorem (2 hours) Separation of variables for the heat equations, existence of solutions (4 hours) D'Alambert's solution of the wave equation (2 hours) Separation of variables for the wave equation, existence of solutions (4 hours) The maximum principle and the mean value principle for harmonic functions (2 hours) Separation of varibles for the Laplace equation for rectangular and circular domains, existence and uniques of solutions (3 hours) Poisson formula (1 hour)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Class attendance and partial written exams.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	1	Oral exam	2		
Written exam	1	Project			

Assessment and evaluation of student work	Partial written exams and final written and oral exam. Positive grade of the written exam is required to take the oral exam.		
Required literature		Number	

	Title	of copies available	Availability on other medium
	Y. Pinchover, J. Rubinstein, An Introduction to Partial Differential Equations, Cambridge University Press, 2007.		
Supplementary literature	D. Bleeker, G. Csordas, Basic Partial Differential Equations, Van Nostrand Reinhold, New York, 1992. T. Myint-U, L. Debnath, Linear Partial Differential Equations for Scientists and Engineers, 4. izdanje, Birkhauser, Boston, 2007.		
Quality assurance	Anonymous student evaluations at the end of semester according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Partial Differential Equations		
ID	PMM915	Study year	1.
Lecturer	prof. dr. sc. Saša Krešić Jurić	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Elective	Online percentage	0%

Subject description

Subject goals	The course objective is to introduce students to the theory of partial differential equations (PDE) and to teach them basic techniques for finding their solutions. The emphasis is on understanding the theoretical results as well as developing practical skills for problem solving.
Enrolment requirements	Prerequisites: completed courses Differential and Integral Calculus 1 and 2 (or Mathematics 1 and 2), Linear Algebra (or Linear Algebra and Matrix Calculus) and Ordinary Differential Equations (or Differential Equations) Required competences: knowledge of differential and integral calculus in one and two varibles, matrix calculus and ordinary differential equations
Learning outcomes	It is expected that the student will be able to: 1. find Fourier series of a given function, 2. classify second order linear PDEs in two variables, 3. formulate stability problems of PDEs for different types of inital and boundary conditions, 4. find solutions of the heat equation and wave equation by the method of separation of variables, 5. find D'Alambert's solution of the wave equation, 6. find solutions of the Laplace and Poisson equations by the method of separation of varibles for rectangular and circular domains. It is also expected that the student is able to prove the theorems used in the development of the theory of PDEs.
Syllabus	1. Introduction and elementary techniques (2 hours) 2. Initial and boundary conditions, stability of solutions (2 hours) 3. Fourier series (2 hours) 4. Dirichlet's theorem, uniform convergence (2 hours) 5. Classification of second order equatins (2 hours) 6. Canonical forms of hyperbolic, parabolic and elliptic equations (2 hours) 7. The maximum principle for the heat equation, the uniqueness theorem (2 hours) 8. Separation of variables for the heat equations, existence of solutions (4 hours) 9. D'Alambert's solution of the wave equation (2 hours) 10. Separation of variables for the wave equation, existence of solutions (4 hours) 11. The maximum principle and the mean value principle for harmonic functions (2 hours) 12. Separation of varibles for the Laplace equation for rectangular and circular domains, existence and uniques of solutions (3 hours) 13. Poisson formula (1 hour)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Class attendance and partial written exams.

Monitoring student work						
	Class attendance		Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project			

Assessment and evaluation of student work	Partial written exams and final written and oral exam. Positive grade of the written exam is required to take the oral exam.

Required literature	Title	Number of copies available	Availability on other medium
	–		

Supplementary literature	D. Bleeker, G. Csordas, Basic Partial Differential Equations, Van Nostrand Reinhold, New York, 1992. T. Myint-U, L. Debnath, Linear Partial Differential Equations for Scientists and Engineers, 4th ed., Birkhauser, Boston, 2007.
Quality assurance	Anonymous student evaluations at the end of semester according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Pedagogy		
ID	PMS170	Study year	1.
Lecturer	doc. dr. sc. Anna Alajbeg	Points value (ECTS)	3.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 0, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description

Subject goals	Acquisition of knowledge and skills in the field of educational theory and practice necessary for the successful organization of educational activities and conduction of pedagogical processes.
Enrolment requirements	No
Learning outcomes	1. To distinguish the fundamental pedagogical processes 2. To recognize opportunities of pedagogical activities 3. To master contents of pedagogical activities and raise awareness of its level 4. To develope competencies for successful planning, organizing and evaluating the teaching process
Syllabus	1.Pedagogy as a scientific discipline 2. Pedagogy and personality 3.-5. The basic pedagogical processes 6. Types and forms of social learning 7.-9. Pedagogical development of personalities and pedagogical activity 10.-12. Fields of pedagogical effects and their qualitative levels 13. Methodology of pedagogical effects 14-15. General characteristics of educational systems and the educational system of the Republic of Croatia
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Class attendance, preparation and presentation of the seminar paper, preliminary exams or oral exam (if student wants).

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums	1	Oral exam			
Written exam		Project			

Assessment and evaluation of student work	Class attendance and activity, the results of preliminary exams or written exam results or results of oral exam (if student wants).

Required literature

Title	Number of copies available	Availability on other medium
Gudjons, H. (1994.): Pedagogija - temeljna znanja. Educa, Zagreb.		
Lenzen, D. (2002.): Vodič za studij znanosti o odgoju. Educa, Zagreb.		
Milat, J. (2005.): Pedagogija - teorija osposobljavanja. Školska knjiga, Zagreb.		

Supplementary literature	Zaninović, M. (1988.): Opća povijest pedagogije. Školska knjiga, Zagreb. Fulgosi, A. (1987.): Psihologija ličnosti. Školska knjiga, Zagreb. Giesecke, H. (1993.): Uvod u pedagogiju. Educa, Zagreb.
Quality assurance	Consultations, discussion, active participation, evaluation.
Other (in the opinion of the	* Contents are listed for academic block-hours (15 terms x 2 hours)

proponent)	** Seminar papers are presented in seminar groups (15x1 per group)

<table>
<tr><td>Subject name</td><td colspan="7">Pedagogija adolescencije</td></tr>
<tr><td>ID</td><td>PMS175</td><td>Study year</td><td colspan="5">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Anna Alajbeg</td><td>Points value (ECTS)</td><td colspan="5">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td colspan="2">P</td></tr>
<tr><td>15</td><td>15</td><td>0</td><td colspan="2">0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="5">0%</td></tr>
<tr><td colspan="8">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="7"></td></tr>
<tr><td>Enrolment requirements</td><td colspan="7"></td></tr>
<tr><td>Learning outcomes</td><td colspan="7"></td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td colspan="5">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="7"></td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td colspan="2"></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="7"></td></tr>
<tr><td rowspan="2">Required literature</td><td>Title</td><td colspan="3">Number of copies available</td><td colspan="3">Availability on other medium</td></tr>
<tr><td colspan="7">–</td></tr>
<tr><td>Supplementary literature</td><td colspan="7"></td></tr>
<tr><td>Quality assurance</td><td colspan="7">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="7"></td></tr>
</table>

Subject name	Pedagogy of spare time		
ID	PMS172	Study year	1.
Lecturer	Antonija Bašić, pred.	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 15, S: 15, E: 0, P: 0
Subject status	Elective	Online percentage	0%

Subject description

Subject goals	To become aware of the importance of designing leisure time for children and young people and their education in leisure- for leisure.
Enrolment requirements	Pedagogy (79121) and Didactics (79107) passed
Learning outcomes	1.Recognizing the space of free time as an area of relaxation, recreation and self-realization. 2.Recognizing free time as an area of primary prevention of behavioral disoreders. 3.Understanding the specifics of children and young people to articulate their leisure 4. Importance of an diversity of leisure activities and the right to choose.
Syllabus	1.Pedagogy of leisure time in pedagogy disciplines 2.-4. Leisure time - the concept and understanding 5.-7. The functions and types of leisure time 8-9. The characteristics of youth leisure 10-11. Peculiarities of youth and leisure 12-13. Youth activities in leisure 14. Socially desirable youth activities in the area of leisure 15. The area of leisure
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Class attendance, the preparation and presentation of a seminar paper, written exam or oral exam (if student wants).

Monitoring student work

Class attendance	0.5	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	0.5		
Colloquiums		Oral exam	1		
Written exam		Project			

Assessment and evaluation of student work	Class attendance and activity, the results of preliminary exams or written exam results or results of oral exam (if student wants).

Required literature

Title	Number of copies available	Availability on other medium
Arbunić, A. (2002.): Struktura slobodnog vremena djece (učenika) osnovnoškolske dobi. FF, Zagreb (neobjavljena doktorska disertacija).		
Plenković, J. (2000.): Slobodno vrijeme mladeži. Sveučilište u Rijeci, Rijeka.		

Supplementary literature	Martinić, T. (1977.): Slobodno vrijeme i suvremeno društvo. Informator, Zagreb. Ilišin, V. (2001.): Djeca i mediji. Državni zavod za zaštitu obitelji, materinstva i mladeži, Zagreb.
Quality assurance	Consultations, discussion, active participation, evaluation.
Other (in the opinion of the proponent)	* Seminar papers are presented in seminar groups (15x1 per group) and they represent a presentation of an scientific work from the area of leisure time.

<table>
<tr><td>Subject name</td><td colspan="3">Short Course on Marine Data Literacy</td></tr>
<tr><td>ID</td><td>PMP26H</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Jadranka Šepić</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 20
S: 0
E: 24
P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>70%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">• Acquire skills to source, use and manage ocean data proficiently
• Learn about best practices on data exchange and FAIR principles including the organization, formats, documentation, storage and security of data following metadata standards
• Learn about reliable data sources through a practical approach on the use of existing databases/services (especially CMEMS and EMODnet) and on how they can be accessed and used
• Practise the efficient use of data in applied research and data-based assessments such as through visual analysis and professional data analysis toolboxes.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">• Basics of programming</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">• Identify different types and formats of available scientific data;
• Understand the basics of data processing and extraction of knowledge from data;
• Understand how relevant data may be acquired to fit the needs of users such as in fisheries resource assessment and management, water quality monitoring and the general state of health of the sea;
• Give appropriate importance of data to prove theoretical concepts and/or draw scientific conclusions.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Introduction to marine data
2. Reliable oceanographic data sources: met-ocean data sets: climate, reanalysis, forecast and in situ data
3. Online data portals
4. Accessing and transforming data
5. Reliable oceanographic data sources: Ocean remote sensing: data source, downloading and software (SNAP)
6. Applying AI to Oceanography
7. Introduction to learning algorithms, neural networks and clustering
8. Applying AI to oceanography: case studies
9. Model and satellite CMEMS data
10. Sea-level time series: detecting processes, stationarity and trends
11. Marine data visualization and analysis with Ocean Data View (ODV)
12. Marine Biogeochemistry: monitoring programs, observational platforms and associated data products
13. Oil spill detection from space with SENTINEL-1
14. Primary production time series analysis and model parameter estimation
15. Reliable oceanographic data sources: Introduction to sea state and wind wave characterization
16. Wave climate characterization</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☑ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attend at least 70% of lectures and 70% of exercises.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1.5 | Research: | Practical work: 1
Experimental work: | Paper: | :
Essay: | Seminar paper: | :
Colloquiums: | Oral exam: | :
Written exam: 0.5 | Project: | :</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Students are evaluated after each lecture; and after each practical session. Students need to do a research assignment within a group of international students; write a report and present results of their research.</td></tr>
</table>

Required literature	Title	Number of copies available	Availability on other medium
	–		
Supplementary literature			
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.		
Other (in the opinion of the proponent)	This is a joint course of six SEA-EU Universities with lecturers coming from all seven University. The course is divided into two parts. The first introduction part consists of lectures and is held entirely on-line; the second part is practical, it consists of exercises, one is held at one of the seven Universities as an intensive training week. It is also possible to take the second part of course entirely on-line.		

<table>
<tr><td>Subject name</td><td colspan="3">Teaching students with special needs</td></tr>
<tr><td>ID</td><td>PMS140</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>Antonija Bašić, pred.</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15 | S: 15 | E: 0 | P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Ability to develop an inclusive curriculum in primary and secondary schools</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">-language, computer and information literacy;</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Ability to work in teams in pedagogical diagnosis of special needs students in an inclusive environment</td></tr>
<tr><td>Syllabus</td><td colspan="3">1.. Introduction to the object
2. Terminology children with special needs
3. Students with disabilities under the Ordinance on primary and secondary education students with disabilities
4. Suitable programs for students with disabilities.
5. Regular program with an individualized approach and tailor the content for students with sight and hearing difficulties.
6. Sixth regular program with an individualized approach and tailor the content for students with speech and language difficulties.
7. Regular program with an individualized approach and tailor the content for students with disabilities reading, writing and numeracy.
8. Regular program with an individualized approach and tailor the content for students with behavioral disorders.
9. Regular program with an individualized approach and tailor the content for students with motor impairments
10.Regular program with an individualized approach and tailor the content for students with intellectual disabilities
11. Regular program with an individualized approach and tailor the content for students with autistic spectrum disorders.
12. Observation techniques and methods of teaching students with disabilities
13. Framework for the promotion and adaptation of learning experiences and evaluation of the achievements of students with disabilities and
14.Customizing content for gifted pupils
15. Framework for promoting learning experiences and evaluation of the achievements of gifted students</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Students are, in accordance with the existing regulations, obliged to participate in all forms of instruction</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 0.5 | Research: | Practical work:
Experimental work: | Paper:
Essay: | Seminar paper: 0.5
Colloquiums: | Oral exam: 1
Written exam: | Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Assessment of knowledge, skills and competence is carried out during the semester by evaluating students’ activities during lectures and seminars, including oral examination.</td></tr>
<tr><td>Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td></td><td>Pravilnik o osnovnoškolskom i srednjoškolskom odgoju i obrazovanju učenika s teškoćama u razvoju travanj,</td><td></td><td>web</td></tr>
</table>

	2015. NN.		
	Jensen, E. : Različita djeca različiti učenici, Educa, Zagreb,2004		
	Bouillet, D.(2010). Izazovi integriranog odgoja i obrazovanja. Zagreb: Školska knjiga.		
	Nacionalni okvirni kurikulum za predškolski odgoj i opće obvezno obrazovanje u osnovnoj i srednjoj školi. R. Hrvatska, Ministarstvo znanosti, studeni 2008		web
	Zrilić, S. (2011). Djeca s posebnim potrebama u vrtiću i nižim razredima osnovne škole. Zadar: Sveučilište u Zadru.		
Supplementary literature	Remscmidt, K, Autizam, Slap, 2008. (some chapters)		
Quality assurance	Advisory hours, conversation, active participation, evaluation conducted by the Quality Assurance Board		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">History of Classical Physics</td></tr>
<tr><td>ID</td><td>PMP009</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Željka Sanader Maršić</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">To understand the development of physical concepts.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">To be able to explain the role physical concepts in:
1. Mechanics
2. Electrodynamics
3. Thermodynamics
4. Statistical mechanics</td></tr>
<tr><td>Syllabus</td><td colspan="3">The following concepts are elaborated:
1. Space, time, motion
2. Force, energy
3. Electric and magnetic field
4. Electromagnetic waves
5. Heat and temperature
6. Free energy and entropy</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☑ Mentoring</td><td>☑ Sokratovski dijalog
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending all forms of teaching.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>2</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Activity during classes seminar and final exam</td></tr>
<tr><td>Required literature</td><td colspan="3"><table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>James T. Cushing: Philosophical Concepts in Physics: The Historical Relation between Philosophy and Scientific Theories, Cambridge University Press, 1998.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">1. Peter Michael Harman: Energy, Force and Matter: The Conceptual Development of Nineteenth-Century Physics, Cambridge University Press, 1982.
2. Robert D. Purrington: Physics in the Nineteenth Century, Rutgers University Press, 1997</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Tests.
Statistics of the results of exams.
Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	History of Modern Physics		
ID	PMP103	Study year	1.
Lecturer	prof. dr. sc. Mile Dželalija	Points value (ECTS)	3.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 0, P: 0
Subject status	Elective	Online percentage	30%

Subject description	
Subject goals	Critical understanding of historical development of basic concepts and principles in relativistic physics, quantum physics, elementary particle physics and cosmology.
Enrolment requirements	Basic knowledge of relativistic physics, quantum physics, elementary particle physics, and cosmology.
Learning outcomes	Explain key conceptual elements that characterised classical mechanics, electromagnetism, thermodynamics, and historical cosmologies; Explain philosophical and historical background for development of modern physics; Discus the contribution of main physicists to the development of special relativity, quantum physics, particle physics and cosmology; Describe experiments and events that characterised the development of ideas and experimental techniques in special relativity, quantum physics, particle physics and cosmology; Critically analyse conceptual evolution of knowledge in special relativity, quantum physics, particle physics and cosmology; Discuss methods and tools for historical analyses of development of modern physics; Discuss key challenges of modern physics.
Syllabus	(2h) Key concepts in classical mechanics, electromagnetism, thermodynamics, and historical cosmologies (2h) Key challenges in classical physics (2h) Selected historical experiments related to special theory of relativity (4h) Development of new ideas, models and theories leading to special theory of relativity (2h) Selected historical experiments related to quantum physics (4h) Development of new idea, models and theories leading to quantum physics (2h) Selected historical experiments related to particle physics (4h) Development of new ideas, models and theories leading to models and theories of atoms, nucleus and elementary particles (2h) Selected historical experiments related to development of cosmology (2h) Development of new ideas, models and theories leading to modern cosmology (4h) Challenges of models and theories in modern physics
Teaching types	☑ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☑ Domaće zadaće ☐ ☐ ☐
Student obligations	Homework assignments during semester. Written exam.

Monitoring student work

Class attendance		Research		Practical work	
Experimental work		Paper		Domaće zadaće	1
Essay		Seminar paper	1	Završni ispit	1
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	Homework assignments during semester: 50 %; written exam: 50 %.

Required literature

Title	Number of copies available	Availability on other medium
M. Dželalija: History of Modern Physics, University of Split, Faculty of Science, Split, 2020.		
Selected famous historical research articles in relativistic		

	physics, quantum physics, particle physics and cosmology.		
Supplementary literature	James T. Cushing: Philosophical Concepts in Physics: The Historical Relation between Philosophy and Scientific Theories, Cambridge University Press, 1998. Ž. Dadić, Povijest metoda i ideja u matematici I fizici, ŠK, Zagreb, 1992. I. Supek, Povijest fizike, ŠK, Zagreb, 1980.		
Quality assurance	Discussion with students and analysing their progress in solving problem and assignments. Statistics of exam results and evaluation of efficacy in accordance with the learning outcomes. Student evaluation by anonymous survey conducted according to the rules of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Positive psychology</td></tr>
<tr><td>ID</td><td>PMS150</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Nikola Marangunić</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Knowledge about concept of happiness, satisfaction and meaning of life as well as motivating personal strengths in its accomplishment</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">No</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon completion of the course students will be able to:
1. Interpret position of Positive psychology as a scientific discipline in the field of psychology.
2. Describe fundamental concepts from the field of happiness, well being, positive motivation and emotions.
3. Describe new psychological models which are standing in the basis of human well being and life meaning research.
4. Define theoretical research directions of positive emotions.
5. Name a motivational cycle of encouraging personal strengths in reaching more positive life stand.
6. Interpret ways of educating children to become creative, brave, tolerant and kind adults.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Course introduction;
2. Introduction to the field of positive psychology;
3. What is happiness?;
4. Positive states: positive emotions;
5. Positive
states: subjective well being;
6. Happy and unhappy people/children:
position, traits, motivation;
7. Positive relationships Part 1;
8. Positive relationships Part 2;
9. Positive community Part 1;
10. Positive community Part 2
11. Positive community Part 3;
12. Positive psychology in practice: pre-school education;
13. Positive psychology in practice: optimistic child;
14. Positive psychology in practice: positive adolescence;
15. Future of positive psychology</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☑ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending lectures, active participation, written seminar.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The presence and activity in class, seminar papers.</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Brdar, I., Rijavec, M. i Miljković, D. (2008): Pozitivna psihologija, IEP, Zagreb.</td><td></td><td></td></tr>
</table></td></tr>
</table>

	Seligman, M.E.P. (2005):Optimistično dijete: provjereni program za prevenciju i trajnu zaštitu djece od depresije, IEP, Zagreb.		
Supplementary literature	Miljković, D. i Rijavec, M. (2004): Tri puta do otoka sreće, IEP, Zagreb		
Quality assurance	Conversation, active participation, evaluation of subject and teacher.		
Other (in the opinion of the proponent)			

Subject name	Laboratory in Biophysics		
ID	PMP142	Study year	1.
Lecturer	doc. dr. sc. Lucija Krce	Points value (ECTS)	4.0
Associates		Class execution (number of hours in semester)	L: 10 S: 0 E: 40 P: 0
Subject status	Compulsory	Online percentage	0%
Subject description			
Subject goals	Understanding the working principles of biophysical experimental methods and techniques. Hands-on data collection in the basic operating modes of AFM, SEM, DLS and fluorescence microscope. Understanding and evaluating the obtained measurements.		
Enrolment requirements	After passing the course, students will be able to: 1. Master the basics of handling bacterial cultures 2. measure and determine the concentration of peptides and their influence on prokaryotic and eukaryotic cells 3. Understand the working principle and application of the scanning electron microscope (SEM) 4. Analyze measurements in ImageJ and Gwyddion software 5. Understand the principle of operation and application of the transmission electron microscope (TEM) 6. Understand the principle of operation and application of the atomic force microscope (AFM) 7. Understand the principle of operation and application of a fluorescence microscope 8. To measure the Young's modulus of elasticity of human cells 9. Understand the principle of operation and application of dynamic light scattering (DLS) devices 10. Measure the size distribution of micelles using DLS		
Learning outcomes	Lectures: (2h) basics of atomic force microscopy and application in biophysics (1h) basics of atomic force spectroscopy and application in biophysics (2h) basics of scanning electron microscopy and applications in biophysics (2h) basics of transmission electron microscopy and applications in biophysics (2h) basics of dynamic light scattering and applications in biophysics (1h) basics of fluorescence microscopy and application in biophysics Exercises: Antimicrobial peptides (AMP) - measurement of concentration and activity (4h) Design of peptides and determination of biophysical characteristics with available 'on-line' tools (2h) Determination of peptide concentration - spectrophotometric measurement (2h) Minimum inhibitory concentration of AMP		
Syllabus	(2h) Hemolytic activity of AMP (1h) SEM measurements of the AFM sample (3h) Preparation of bacterial samples for SEM analysis (4h) SEM measurements of bacterial cells (2h) Analysis of SEM data in ImageJ software (1h) Preparation of bacterial samples for measurements on a fluorescence microscope (1h) Measurement on a fluorescence microscope (1h) Analysis of fluorescence images in Image software (2h) Preparation of samples for TEM analysis and use of TEM (1h) Preparation of human cells for AFM analysis (4h) AFM measurements (2h) AFM data processing in Gwyddion software (2h) Atomic force spectroscopy on human cells (2h) Processing of curves collected by means of atomic force spectroscopy - measurement of Young's modulus using the Hertz/Sneddon model (1h) Sample preparation for DLS measurements (2h) Micelle size distribution measurements by DLS. (1h) DLS data processing.		
Teaching types	☑ Lectures ☐ Seminars	☐ Fieldwork ☑ Individual assignments	☐

	Exercises Fully online Combined online	Multimedia Laboratory Mentoring	
Student obligations			

Monitoring student work	Class attendance	0.4	Research	0.5	Practical work	
	Experimental work	1.1	Paper	2		
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project			
Assessment and evaluation of student work						

Required literature	Title	Number of copies available	Availability on other medium
	Internal materials	0	yes
	Scientific articles in biophysics	0	yes
Supplementary literature			
Quality assurance	Phillips, Kondev, Theriot: Physical biology of the cell, Garland Science, 2009		
Other (in the opinion of the proponent)			

Subject name	Laboratory Course in Biochemistry		
ID	PMC107	Study year	3.
Lecturer	doc. dr. sc. Viljemka Bučević Popović	Points value (ECTS)	4.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 60, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description

Subject goals	Through their practical work, students are getting familiar with the properties of biological molecules (amino acids, enzymes etc.) and the methods used for their analysis and separation.
Enrolment requirements	Having attended Biochemistry I is the course enrolment requirement needed for the course. Entry competences needed are: • Being familiar with basic principles of wok in a chemistry laboratory.
Learning outcomes	After completing the exam, the student will be able to: 1. Describe and interpret the acid-base properties of amino acids 2. Measure enzyme activity, display and analyze kinetics of enzyme reactions 3. Apply electrophoresis technique for biological macromolecule analysis 4. Conduct protein separation by gel filtration 5. Determine protein concentration 6. Analyze the concentration of various biological molecules in natural samples.
Syllabus	Laboratory exercises: 1. Acid-base properties of amino acids (4 hours) 2. Time course of enzyme reaction. Enzyme kinetics (6 hours) 3. Inhibition of enzyme reaction. Activation of the enzyme reaction (6 hours) 4. Influence of temperature on enzyme activity (4 hours) 5. Protein electrophoresis (6 hours) 6. Nucleic acid electrophoresis (4 hours) 7. Protein separation methods. Gel-filtration (6 hours) 8. Determination of protein concentration by Bradford method (3 hours) 9. Determination of enzyme activity in natural samples: alkaline phosphatase in the sea water (6 hours) 10. Determination of enzyme activity in natural samples: α-amylase in saliva and serum (4 hours) 11. Determination of cholesterol concentration (3 hours) 12. Determination of bilirubin concentration (4 hours) 13. Determination of iron and iron binding capacity (4 hours)
Teaching types	☐ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Attending classes, entry quizzes, lab report, exam

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper		Priprema izvještaja s vježbi	0.5
Essay		Seminar paper			
Colloquiums	0.5	Oral exam			
Written exam	1	Project			

Assessment and evaluation of student work	Entry quizzes - 10 % Lab report and performance in the lab - 10% Written exam - 80%.

Required literature

Title	Number of copies available	Availability on other medium
Praktikum iz biokemije (interna skripta)		dostupno

	Stryer, Berg, Tymoczko, Biokemija, Školska knjiga, 2013.		
Supplementary literature	Voet, Voet: Biochemistry, 4 izd., John Wiley & Sons, 2011.		
Quality assurance	The quality of teaching will be monitored by collecting feedback from students through personal consultations, joint conversations and anonymous student surveys. The students' performance in the final exam will be analyzed and used to improve the teaching performance in the next academic year.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Laboratory in Electricity and Magnetism</td></tr>
<tr><td>ID</td><td>PMP012</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Ante Bilušić</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 0 | S: 0 | E: 40 | P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Understanding the laws of electromagnetism through independent performance of selected experiments.
Understanding and application of the detailed statistical analysis of experimental results</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Acquired learning outcomes in electricity and magnetism</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Correctly use measuring instruments to measure charge, electric voltage, and electric current, including the oscilloscope, and explain their operation.
2. Use current- and voltage-sources correctly.
3. Design and conduct experiments that verify the laws of electromagnetism.
4. Explain the role and operation of a specific part of the experiment. Suggest possible improvements to the experiment.
5. Evaluate the accuracy of the instrument and determine the significant digits of the measurement results.
6. Calculate and discuss the contribution of random and systematic errors to the measurements and eliminate the influence of errors on the results obtained.
7. When analyzing data, identify and apply the appropriate physical model from the field of electromagnetism that explains the experimental results.
8. Through research and using additional literature, identify possible alternative physical models and discuss their application in analyzing the data obtained.
9. Write a detailed laboratory report in the form of a scientific-journal article, using the scientific method.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Laboratory includes the following experiments:
• Electrical capacity of the electrometer
• Resistance measurements and Ohm's law
• Wheatstone bridge
• RC-circuit
• RLC-circuit
• Transformer
• Interaction of the magnetic dipole moment and the magnetic field
• Magnetic induction</td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☑ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Writing reports on the conducted experiments. Attendance.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td>1.5</td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">During each term the student's knowledge of the experiment is verbally verified, while on each performed experiment students have to write a report that will be evaluated. The exam consists in the performance of one of the experiments. The final score is based on the knowledge shown during classes and exam, and on reports on conducted experiments.</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td></tr>
</table>

	Ante Bilušić, Praktikum iz opće fizike II, skript, in Croatian	0	yes (free access)
Supplementary literature	[1] Halliday, Resnick, Walker: Fundamentals of Physics, John Wiley & Sons, 2003.		
Quality assurance	1. Lecturers who have subjects with correlated learning outcomes work together to ensure quality of learning. 2. Statistics of test scores and assessment of performance in accordance with established learning outcomes.		
	3. Evaluation of students through an anonymous survey conducted in accordance with the regulations of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Laboratory course in physical chemistry		
ID	PMC113	Study year	1.
Lecturer	izv. prof. dr. sc. Perica Bošković	Points value (ECTS)	3.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 45, P: 0
Subject status	Compulsory	Online percentage	0%

Subject description	
Subject goals	Objectives of the course are to introduce students with 1. Perform measurements in a physico-chemical laboratory independently or in team work, present and process measurement results, 2. application of the acquired knowledge and skills in professional and specialist subjects
Enrolment requirements	Entry competences required for this course are knowledge of mathematics (calculus) and general physics and chemistry.
Learning outcomes	After successfully passing a course, students will be able to: 1. Self-conducting laboratory experiments and measurements, 2. Calculate the physico-chemical parameters using thermodynamic and kinetic equations, 3. Interpret experimental and computational data, 4. Compute the various physico-chemical dependencies of the studied systems.
Syllabus	Exercises in Physical Chemistry Laboratory (5 hours a week): 1. Surface tension and refractometry. 2. Viscosity. 3. Determination of molar mass by freeze point depression method 4. Adsorption from aqueous solutions. 5. Homogeneous chemical equilibrium. 6. Solubility curve for a ternary system. 7. Conductometry and conductometric titration. 8. Galvanic cells and electrode potentials. 9. Determination of the sucrose inversion rate constant by polarimetric.measurement
Teaching types	[ ] Lectures [ ] Seminars [x] Exercises [ ] Fully online [ ] Combined online [ ] Fieldwork [x] Individual assignments [ ] Multimedia [x] Laboratory [ ] Mentoring
Student obligations	Attendance and activity in laboratory exercises in the amount of 100 % of the anticipated hourly rate. Performing all laboratory exercises and writing reports. Continuous assessment of knowledge through a test before the lab exercise.

Monitoring student work

Class attendance		Research		Practical work	1
Experimental work	0.5	Paper		Konzultacije	0.2
Essay		Seminar paper		Report	0.8
Colloquiums		Oral exam	0.5		
Written exam		Project			

Assessment and evaluation of student work	Continuous evaluation: efficacy(%) / percentage in grade (%)) attendance and teaching activity: (100/10) • oral exam (60 - 100/25) Measurement performance: (60 - 100/25) • Writing reports (experimental data, computational data, tables and graphs, conclusion): (100/10) 60 - 100/40)

Required literature

Title	Number of copies available	Availability on other medium
R. J. Silbey, R. A. Alberty, M. G. Bawendi, Physical Chemistry, 4th Edition, John Wiley and Sons, New Jersey, 2005.		

Supplementary literature	A. M. Halpern, Experimental Physical Chemistry, A Laboratory Textbook, 2nd Edition, Prentice Hall, New Jersey, 1997.
Quality assurance	Continuous evaluation by monitoring activities and testing, anonymous survey.

Other (in the opinion of the proponent)	

Subject name	Laboratory in Mechanics		
ID	PMP011	Study year	2.
Lecturer	prof. dr. sc. Ante Bilušić	Points value (ECTS)	3.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 40, P: 0
Subject status	Compulsory	Online percentage	20%

Subject description

Subject goals	Understanding the laws of mechanics through independent performance of selected experiments. Understanding and application of the detailed statistical analysis of experimental results.
Enrolment requirements	Acquired learning outcomes in mechanics.
Learning outcomes	1. Correctly apply and explain the operating principle of measuring instruments used to measure length, time, mass, force, and pressure. 2. Plan and conduct experiments to verify the laws of mechanics of a material point, a solid body, and fluids. 3. Explain the role and operation of a specific part of the experiment. Suggest possible improvements to the experiment. 4. Evaluate the accuracy of the instrument and determine the significant digits of the measurement results. 5. Calculate and discuss the contribution of random and systematic errors to the measurements and eliminate the influence of errors on the results obtained. 6. When analyzing data, identify and apply the appropriate physical model from the field of mechanics that explains the experimental results. 7. Through research and using additional literature, identify possible alternative physical models and discuss their application in analyzing the data obtained. 8. Write a detailed laboratory report in the form of a scientific-journal article, using the scientific method.
Syllabus	Laboratory includes the following experiments: • Length and mass measurements • Measurement of the fluid density • Energy conservation law • Moment of inertia • Pendulum with the variable constant of gravity • Physical pendulum • Elasticity • Torsion pendulum • Surface tension
Teaching types	☐ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring
Student obligations	Writing reports on the conducted experiments. Attendance.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper	1.5		
Essay		Seminar paper			
Colloquiums		Oral exam	0.5		
Written exam		Project			

Assessment and evaluation of student work	During each term the student's knowledge of the experiment is verbally verified, while on each performed experiment students have to write a report that will be evaluated. The exam consists in the performance of one of the experiments. The final score is based on the knowledge shown during classes and exam, and on reports on conducted experiments.

Required literature

Title	Number of copies available	Availability on other medium

	Ante Bilušić, Praktikum iz opće fizike I, script, in Croatian	0	yes (free access)
Supplementary literature	[1] Antonije Dulčić, Miroslav Požek, Nikola Poljak: Mehanika, Školska knjiga, Zagreb, 2023., in Croatian [2] Halliday, Resnick, Walker: Fundamentals of Physics, John Wiley & Sons, 2003.		
Quality assurance	1. Lecturers who have subjects with correlated learning outcomes work together to ensure quality of learning. 2. Statistics of test scores and assessment of performance in accordance with established learning outcomes. 3. Evaluation of students through an anonymous survey conducted in accordance with the regulations of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Laboratory in Chemistry Education I		
ID	PMC213	Study year	2.
Lecturer	dr. sc. Roko Vladušić, v. pred.	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 45, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description

Subject goals	The goal of the course is to prepare students for design and implementation of elementary school chemistry experiments in chemistry instruction. Special attention is paid to the development of the awareness how important role experiments do play in chemistry instruction.
Enrolment requirements	Chemistry Education I obligations completed (except exam); starting competencies are related to the knowledge of chemistry and ability to work with chemicals in secure and economic way.
Learning outcomes	According to the elementary school curriculum, students will be able to: – design and develop worksheets for implementation and evaluation of experimental work, – prepare and implement demonstrational and laboratory types of experiments, – create experimental situations in which pupils should make conclusions based on observations and theoretical knowledge, – perform all laboratory procedures related to experiments listed in Chemistry curriculum for elementary school, – demonstrate practical work skills and – analyse the flow and results of an experiment with focus on the cause-effect relationships
Syllabus	1. Substances and their properties (5 hours) 2. Types of substances (5 hours) 3. Air (5 hours) 4. Water and hydrogen (5 hours) 5. Composition of substances (5 hours) 6. Chemical changes (5 hours) 7. Elements and compounds (5 hours) 8. Metals, non-metal and salts (6 hours) 9. Carbon and its inorganic compounds (4 hours).
Teaching types	[ ] Lectures [ ] Seminars [x] Exercises [ ] Fully online [ ] Combined online [ ] Fieldwork [x] Individual assignments [x] Multimedia [x] Laboratory [ ] Mentoring
Student obligations	To attend laboratory exercises, to design and perform experiments, to develop worksheet for experiment implementation in classroom.

Monitoring student work

Class attendance		Research		Practical work	
Experimental work	1.5	Paper		Individual laboratory tasks	0.5
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	Preparation, implementation and analysis of experiments – 100 % (or final experimental exam – 80 %; creating worksheets, structuring experiments and experimental skills – 20 %).

Required literature

Title	Number of copies available	Availability on other medium
Sikirica, M. (2011). Zbirka kemijskih pokusa za osnovnu i srednju školu, Školska knjiga, Zagreb.		
Chemistry textbooks applied by Ministry of science and education		

Supplementary literature	Sikirica, M. (2004). Metodika nastave kemije, Školska knjiga, Zagreb.
Quality assurance	Personal consultations, individual tasks analysis, group conversation, institutional evaluation at the end of the semester.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Laboratory in Chemistry Education II</td></tr>
<tr><td>ID</td><td>PMC214</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>dr. sc. Roko Vladušić, v. pred.</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 0, S: 0, E: 45, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The goal of the course is to prepare students for design and implementation of secondary schools' chemistry experiments in chemistry instruction. Special attention is paid to the development of the awareness how important role experiments do play in chemistry instruction.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Laboratory in Chemistry Education I obligations completed (except exam); starting competencies are related to the knowledge of chemistry and ability to work with chemicals in secure and economic way.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">According to the secondary schools curriculum, students will be able to:
– design and develop worksheets for implementation and evaluation of experimental work,
– prepare and implement demonstrational and laboratory types of experiments,
– create experimental situations in which pupils should make conclusions based on observations and theoretical knowledge,
– perform all laboratory procedures related to experiments listed in Chemistry curriculum for elementary school,
– demonstrate practical work skills and
– analyse the flow and results of an experiment with focus on the cause-effect relationships.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Carbohydrates (5 hours)
2. Organic compounds with oxygen (5 hours)
3. Biologically important compounds (6 hours)
4. Polymers (4 hours)
5. Chemical bonding and crystals (5 hours)
6. Types of dispersion systems (5 hours)
7. Changes of energy in reaction systems (5 hours)
8. Chemical equilibrium (5 hours)
9. Electrochemistry (5 hours)</td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☐ Fieldwork
☑ Individual assignments
☑ Multimedia
☑ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Pohađanje nastave, ispunjavanje individualnih i grupnih zadataka.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td>1.5</td><td>Paper</td><td></td><td>Osobni laboratorijski zadatak</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td>Problem analasis</td><td>1</td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Priprema, provedba i analiza zadanih eksperimenata – 100 % (ili završni eksperimentalni test - 80 %; osmišljavanje radnih materijala, strukture eksperimenata i vještine eksperimentiranja - 20 %)</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>Sikirica, M. (2011). Zbirka kemijskih pokusa za osnovnu i srednju školu, Školska knjiga, Zagreb.</td><td></td><td></td></tr>
<tr><td>Chemistry textbooks applied by Ministry of science and education</td><td></td><td></td></tr>
</table></td></tr>
</table>

Supplementary literature	Sikirica, M. (2004). Metodika nastave kemije, Školska knjiga, Zagreb.
Quality assurance	Personal consultations, individual tasks analysis, group conversation, institutional evaluation at the end of the semester.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Laboratory in Modern Physics</td></tr>
<tr><td>ID</td><td>PMP20F</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Lucija Krce</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 0, S: 0, E: 40, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Understanding the laws of modern physics through the independent performance of selected experiments. Understanding and applying statistical analysis of experimental results. Computer application in statistical processing of results.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">by applying knowledge from modern physics to understand the theoretical background of selected experiments
using the understanding of modern physics to describe the parts and principles of operation of selected experiments
by applying knowledge in the field of measurement in physics and by applying computers, statistically analyze the results obtained by measurements, by using knowledge in the field of measurement in physics and based on the results of statistical analysis to identify and understand measurement errors</td></tr>
<tr><td>Syllabus</td><td colspan="3">Specific charge of an electron
Hall effect
Planck's law of radiation
Measurement of the Planck constant
Temperature dependence of resistance of conductors and semiconductors
Determination of silver nanoparticle size by UV-VIS spectroscopy</td></tr>
<tr><td>Teaching types</td><td colspan="3">☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☑ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Writing reports on the conducted experiments. Attendance.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td>1.5</td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">During each term the student’s knowledge of the experiment is verbally verified, while on each performed experiment students have to write a report that will be evaluated. The exam consists in the performance of one of the experiments. The final score is based on the knowledge shown during classes and exam, and on reports on conducted experiments.</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Internal script</td><td></td><td>yes</td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Halliday, Resnick, Walker: Fundamentals of Physics, John Wiley & Sons, 2003.
Scientific journals in physics education</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="6">Praktikum iz molekularne genetike</td></tr>
<tr><td>ID</td><td>PPB282</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Željana Fredotović</td><td>Points value (ECTS)</td><td colspan="4">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>0</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">30%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Naučiti studente temeljnim molekularno genetičkim metodama. Upoznati ih s ulogom molekularne genetike u biologiji, medicini i biotehnologiji</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Nema ih.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Studenti će nakon završetka odslušanja predmeta moći:
1.primijeniti teorijsko znanje o bioinformatičkim bazama podataka –
2.konstruirati početnice za lančanu reakciju polimerazom, izvršiti lančanu reakciju polimerazom te izvršiti gel elektroforezu nakon završene lančane reakcije polimerazom
3.izvršiti izolaciju i analizu RNK, sintezu cDNK iz kalupa RNK
4.usporediti primjenu konvencionalnog i Real-time pcr-a
5.samostalno interpretirati i analizirati rezultate konvencionalnog i Real-time pcr-a
6.izvršiti test analize oštećenja DNK
7.interpretirati rezultate testa analize oštećenja DNK
8.vladati tehnikom mikroskopiranja fluorescentnim mikroskopom (uz nadzor)</td></tr>
<tr><td>Syllabus</td><td colspan="6">Predavanja
1.Određivanje citoplazmatskog genotipa kod dalmatinske ljutike (A. x cornutum).
Vježbe
1.Određivanje citoplazmatskog genotipa kod dalmatinske ljutike (A. x cornutum) Pristup online bioinformatičkim bazama podataka i alatima za dizajniranje početnica (Primer Blast): Znati samostalno dizajnirati početnice prema zadanoj DNK sekvenci. Znati se služiti komercijalnim programom za izračunavanje specifične temperature taljenja (Tm), formiranja primer dimera te postotka GC parova. (2 sata)
2.Umnožavanje fragmenta DNK (citoplazmatskog matK gena) lančanom reakcijom polimerazom (PCR): Znati opisati cikluse lančane reakcije polimerazom (PCR), moći samostalno izvršiti umnožavanje citoplazmatskog gena matK na kalupu genomske DNK Allium x cornutum PCR-om (2 sata)
3.Elektroforeza umnoženog matK gena: Znati objasniti princip gel elektroforeze, izračunati potrebne količine pufera i agaroze te znati pripremiti agarozni gel, nanijeti uzorke na gel i interpretirati rezultate gel elektroforeze. (2 sata)
4.Pročišćavanje molekula DNK iz fragmenta gela agaroze: Upoznati se sa principom pročišćavanja DNK uzorka koristeći komercijalni kit (specijalne kolone sa silika gelom koje na sebe vežu DNK) 2. DIO- Mikroelektroforeza pojedinačnih stanica u agaroznom gelu (2 sata)
5.Priprema otopina i mikroskopskih stakalaca: Razviti sposobnost rukovanja laboratorijskim priborom i opremom. Znati izračunati koncentracije i količine potrebnih sastojaka za pripremu otopina. Moći samostalno pripremiti potrebne otopine za test genotoksičnosti. Moći samostalno pripremiti mikroskopska stakalca uranjanjem u otopinu agaroze. (4 sata)
6.Nanošenje stanica na mikroskopska stakalca presvučena agaroznim gelom: Znati samostalno nanijeti stanice na presvučena mikroskopska stakalca. (2 sata)
7.Elektroforeza i bojanje stakalaca: Znati objasniti proces elektroforeze stanica na mikroskopskim stakalcima. Moći samostalno pripremiti kadicu za elektroforezu i izačunati potrebnu jakost i napon struje za elektroforezu. (2 sata)
8.Mikroskopiranje: Razumjeti primjenu fluorescentne boje (DAPI) u bojanju stakalaca. Ovladati tehnikom mikroskopiranja na fluorescentom mikroskopu (uz stalni nadzor). Znati interpretirati dobivene rezultate. 3. DIO- Analiza genske ekspresije lančanom reakcijom polimerazom u stvarnom vremenu (real-time pcr) (2 sata)
9.Izolacija i kultivacija leukocita (2 sata): Znati objasniti postupak izolacije i kultivacije leukocita. (2 sata)
10.Sakupljanje stanica, izolacija RNK te određivanje koncentracije i čistoće RNK: Izvršiti izolaciju i analizu RNK iz stanica leukocita. Znati postupak određivanja koncentracije i čistoće RNK na spektrofotometru. (2 sata)
11.Elektroforeza RNK u denaturirajućim uvjetima: Razumjeti princip agarozne gel elektroforeze u denaturirajućim uvjetima. Znati pripremiti agarozni gel u 1 x TBE</td></tr>
</table>

	puferu. Znati pravilno nanijeti uzorke na gel, spojiti aparaturu i vizualizirati rezultate gel elektroforeze na UV transiluminatoru. Znati interpretirati rezultate.(2 sata) 12.Lančana reakcija polimerazom nakon obrnutog prepisivanja, elektroforeza i pročišćavanje umnoženih fragmenata s gela: Znati princip obrnutog prepisivanja RNK u komplementarnu DNK (cDNA) i umnožavanje dobivene cDNA lančanom reakcijom polimerazom (PCR). • Uspješnost reakcije provjeriti na gelu (elektroforeza). Dobivene produkte izrezati s gela, izvagati i pročistiti kao u vj.4. (4 sata) 13.Lančana reakcija polimerazom u stvarnom vremenu (Real-time pcr): Razumjeti princip metode real-time pcr-a. Znati zašto se koristi fluorescencijska boja za obilježavanje cDNA (SYBR Green). Znati postaviti pcr reakciju (uz nadzor). Znati interpretirati rezultate dobivenih grafova. Na osnovi dobivenih vrijednosti moći odrediti koliko je puta ekspresija gena u nekom uzorku povećana ili smanjena u odnosu na drugi uzorak.(2 sata)
Teaching types	☐ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Student je dužan prisustvovati svim praktičnim vježbama. Studenti su dužni ponijeti laboratorijsku kutu, skriptu, bilježnicu, pisaći pribor i kalkulator.

Monitoring student work

Class attendance		Research		Practical work	
Experimental work	1.0	Paper			
Essay		Seminar paper			
Colloquiums		Oral exam	1.0		
Written exam		Project			

Assessment and evaluation of student work	Provjera domaćih zadataka i završni usmeni ispit.

Required literature

Title	Number of copies available	Availability on other medium
Metode u molekularnoj biologiji. 2007. Andreja Ambriovič Ristov (ur). Institut Ruđer Bošković.		
Puizina, J. 2005: Praktikum iz molekularne biologije, Interna skripta		web
Fredotović, Ž. 2016 Praktikum iz molekularne genetike, Interna skripta		web

Supplementary literature	
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Laboratory Course in Organic Chemistry</td></tr>
<tr><td>ID</td><td>PMC007</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Renata Odžak
izv. prof. dr. sc. Stjepan Orhanović</td><td>Points value (ECTS)</td><td>4.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 0, S: 0, E: 60, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Introduce modern techniques and methods of work in organic chemistry.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Listened Organic chemistry I and enrolled Organic Chemistry II.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After completing the course, the students will be able to:
1. use an apparatus for organic synthesis,
2. to distinguish between functional groups of organic compounds and the ways of their demonstration,
3. apply the extraction method,
4. interpret the results of the product synthesis from the given reactants with the calculation of utilization,
5. apply contemporary techniques of purification of organic preparations and devices in the laboratory for organic chemistry.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Laboratory exercises:
1. Preparation of solutions and reagents (4 hours)
2. Determination of Functional Group of Organic Compounds (4 hours)
3. Separation of the mixture by extraction (4 hours)
4. Separation by column and thin layer chromatography (4 hours)
5. cis-trans isomerism (4 hours)
6. Electrophilic addition (8 hours)
7. Organic reactions of preparation and identification of compounds: Fischer esterification (methyl benzoate) (4 hours)
8. Grignard reaction (triphenylmethanol) (4 hours)
9. Electrophilic substitution of benzene derivatives (p-nitroacetanilide) (4 hours)
10. Isolation and conversion of compounds with their identification: caffeine from tea (4 hours), milk casein (4 hours) and oleic acid from oil (4 hours)
13. Diels-Alder reaction of conjugated dienes in eucalyptus oil (4 hours)
14. Compensation for unfinished exercises (4 hours)</td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3"></td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>1.0</td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td>2.5</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">All exercises must be collapsed and made. The entrance exam is placed before the exercise, and the students work in the laboratory during the same work. Students are obliged to keep a diary in which they enter the results of the experiment. The final written exam of the student is accesses after the exercises are done and the reviewed work journal. For the passing grade, at least 50% of the final exam is needed.</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Internal Script for Laboratory Exercises</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
</table>

Quality assurance	Consultations, student surveys for subject and teacher evaluation, attendance records, and analysis of the success of the colloquium and final exams.
Other (in the opinion of the proponent)	

Subject name	Laboratory in Thermodynamics and Modern Physics		
ID	PMP014	Study year	3.
Lecturer	doc. dr. sc. Lucija Krce	Points value (ECTS)	3.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 40, P: 0
Subject status	Compulsory	Online percentage	20%

Subject description

Subject goals	Understanding the lows of thermodynamics through independent performance of selected experiments. Understanding and application of the detailed statistical analysis of experimental results.
Enrolment requirements	Acquired learning outcomes in thermodynamics and modern physics.
Learning outcomes	1. Correctly use calorimeters, thermometers, vacuum pumps, and radiation intensity meters and explain their operation 2. Design and conduct experiments that test the laws of thermodynamics and modern physics. 3. Explain the role and operation of a specific part of the experiment. Suggest possible improvements to the experiment. 4. Evaluate the accuracy of the instrument and determine the significant digits of the measurement results. 5. Calculate and discuss the contribution of random and systematic errors to the measurements and eliminate the influence of errors on the results obtained. 6. When analyzing data, identify and apply the appropriate physical model from the field of thermodynamics and modern physics. 7. Through research and using additional literature, identify possible alternative physical models and discuss their application in analyzing the data obtained. 8. Write a detailed laboratory report in the form of a scientific-journal article, using the scientific method.
Syllabus	Laboratory includes the following experiments: • Equation of state of ideal gas • Thermal expansion of the solid body • Specific heat capacity of water • Specific heat of ice melting and water evaporation • Specific heat capacity of the solid body • Maxwell-Boltzmann distribution of velocities • Solar cells characteristics • Thermal conduction of metals
Teaching types	☐ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring
Student obligations	Writing reports on the conducted experiments. Attendance.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper	1.5		
Essay		Seminar paper			
Colloquiums		Oral exam	0.5		
Written exam		Project			

Assessment and evaluation of student work	During each term the student's knowledge of the experiment is verbally verified, while on each performed experiment students have to write a report that will be evaluated. The exam consists in the performance of one of the experiments. The final score is based on the knowledge shown during classes and exam, and on reports on conducted experiments.

Required literature

Title	Number of copies available	Availability on other medium

	Ante Bilušić, Larisa Zoranić Praktikum iz opće fizike IV, skripta, in Croatian	0	yes (free access)
Supplementary literature	[1] Halliday, Resnick, Walker: Fundamentals of Physics, John Wiley & Sons, 2003.		
Quality assurance	1. Lecturers who have subjects with correlated learning outcomes work together to ensure quality of learning. 2. Statistics of test scores and assessment of performance in accordance with established learning outcomes. 3. Evaluation of students through an anonymous survey conducted in accordance with the regulations of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Laboratory in Waves and Optics		
ID	PMP013	Study year	3.
Lecturer	doc. dr. sc. Lucija Krce	Points value (ECTS)	3.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 40, P: 0
Subject status	Compulsory	Online percentage	20%

Subject description

Subject goals	Understanding the wave laws and optics through independent performance of selected experiments. Understanding and application of the detailed statistical analysis of experimental results.
Enrolment requirements	Acquired learning outcomes in waves and optics.
Learning outcomes	1. Correctly apply and recognize lens systems. 2. Correctly apply and explain the operation of devices that operate on the principles of wave refraction (e.g., optical prism), wave diffraction (e.g., optical grating), and sources of various waves (e.g., light and mechanical). 3. Understand the spectra of light sources. 4. Design and conduct experiments that test the laws of wave propagation and geometrical and physical optics. 5. Explain the role and operation of a specific part of the experiment. Suggest possible improvements to the experiment. 6. Evaluate the accuracy of the instrument and determine the significant digits of the measurement results. 7. Calculate and discuss the contribution of random and systematic errors to the measurements and eliminate the influence of errors on the results obtained. 8. When analyzing data, identify and apply the appropriate physical model from the field of wave propagation and geometrical and physical optics. 9. Through research and using additional literature, identify possible alternative physical models and discuss their application in analyzing the data obtained. 10. Write a detailed laboratory report in the form of a scientific-journal article, using the scientific method.
Syllabus	Laboratory includes the following experiments: • Standing waves • Refraction of light on the spherical surface – lenses • Newton's rings • Dependence of the refractive index on the frequency of light • Resolving power of the optical grating • Fresnel's equations of the light refraction • Diffraction of sound wave on a slit
Teaching types	☐ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring
Student obligations	Writing reports on the conducted experiments. Attendance.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper	1.5		
Essay		Seminar paper			
Colloquiums		Oral exam	0.5		
Written exam		Project			

Assessment and evaluation of student work	During each term the student's knowledge of the experiment is verbally verified, while on each performed experiment students have to write a report that will be evaluated. The exam consists in the performance of one of the experiments. The final score is based on the knowledge shown during classes and exam, and on reports on conducted experiments.

Required literature		Number	

	Title	of copies available	Availability on other medium
	Ante Bilušić, Larisa Zoranić Praktikum iz opće fizike III, skript, in Croatian	0	yes (free access)
Supplementary literature	[1] Halliday, Resnick, Walker: Fundamentals of Physics, John Wiley & Sons, 2003.		
Quality assurance	1. Lecturers who have subjects with correlated learning outcomes work together to ensure quality of learning. 2. Statistics of test scores and assessment of performance in accordance with established learning outcomes. 3. Evaluation of students through an anonymous survey conducted in accordance with the regulations of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="6">Applied Statistics</td></tr>
<tr><td>ID</td><td>PMIG10</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Vesna Gotovac Đogaš</td><td>Points value (ECTS)</td><td colspan="4">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">30%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">The course objective is to introduce students to the fundamentals of statistical theory and methods, and to teach them practical skills required for statistical analysis and interpretation of results.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">The student is able to:

group gathered statistical data and display them in tables or by using graphical means,

analyse statistical data,

calculate all parameters for given statistical data and interpret their values,

define all basic notions of statistics and probabilty theory,

solve problems of mid range difficulty from the fundamentals of probability theory,

explain and apply all basic statistical tests,

interpret the results of the basic tests.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Statistical populations and statistical variables: frequencies and proportions, classification of qualitative and numerical data (3 hours).

Population parameters: arthimetic mean, standard deviation, standardized statistical variable, geometric and harmonic mean, moments, measures of position (4 hours).

Random experiments: outcomes, operations with outcomes, outcome probability, probability space (discrete and general) (2 hours).

Normal, student and chi-squared distribution, conditional probability, independent events, Bayes' formula (3 hours).

Discrete random variables: the Bernoulli experiment and distribution, the Poisson, hypergeometric, geometric and Pascal distribution (3 hours).

Continuous random variable: density function, expectation, variance (2 hours).

Two dimensional random variable: marginal distributions, conditional distributions, independence, covariance and the correlation coefficient (2 hours).

Samples, estimators for a population parameters (2 hours)

Confidence intervals: arithmetic mean estimates, proportion estimates, variance estimates, testing two means (variances, proportions) (3 hours)

Hypothesis testing, significance level, : Z-test and t-test, testing the variance hypothesis, nonparametric tests (6 hours).</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="4">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Class and tutorial sessions attendance, solving homework problems, self-learning of</td></tr>
</table>

	prescribed material by using the obligatory and optional literature.					
Monitoring student work	Class attendance	1	Research		Practical work	
	Experimental work		Paper		Ispit	5
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project			
Assessment and evaluation of student work	Final written and oral exam. Positive grade at the written exam is required to take the oral exam. The written and oral exam are equally weighted in the final grade.					
Required literature	Title				Number of copies available	Availability on other medium
	N. Koceić Bilan, Primijenjena statistika, skripta PMF Split (2011)					da
Supplementary literature	I. Šošić, Primijenjena statistika , Školska knjiga Zagreb, 2. izdanje (2006) Ž. Pauše, Uvod u matematičku statistiku, Školska knjiga Zagreb (1993)					
Quality assurance	Anonymous student evaluations at the end of semestar according to the regulations of the University of Split.					
Other (in the opinion of the proponent)						

<table>
<tr><td>Subject name</td><td colspan="3">Application of Programming in Physics</td></tr>
<tr><td>ID</td><td>PMP074</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Žarko Kovač
doc. dr. sc. Toni Šćulac</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The course aims to teach students the application of numerical problem-solving in physics. The goal is to enable students to develop algorithms for numerical problem-solving in physics through various examples.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">• Develop or adapt existing algorithms for modeling simple processes and performing calculations, and present solutions graphically.
• Extract parts of an algorithm into separate units and implement them as subprograms or functions with an appropriate method of argument transfer, using libraries and modules.
• Choose an appropriate data record structure for storing data in files on a local or remote computer (repository).
• Format the given problem in a way suitable for computer analysis, using physics concepts and laws, and mathematical analysis.
• Assess and minimize numerical errors and discuss the criteria for applying and limiting some numerical methods.
• Visualize data to facilitate interpretation and formulate data dependence by adjusting a mathematical function to that data.
• Define a model (deterministic, stochastic, or statistical) for the given problem, write a computer program, perform a simulation, and present the results.</td></tr>
<tr><td>Syllabus</td><td colspan="3">(2+2) Introduction, Python Review
(2+2) Modules and Simple Motions
(2+2) Object-Oriented Approach to Algorithm Development
(2+2) Numerical Differentiation and Integration
(2+2) Euler's Method
(2+2) Algorithm for Statistical Data Processing
(2+2) Projectile Motion and Runge-Kutta (RK) Method
(2+2) Understanding Errors in Euler's and RK Methods
(2+2) Modeling Bungee Jumping
(2+2) Modeling of Charged Particle in EM Field
(2+2) Gravitational Interaction of 2 Bodies
(2+2) Gravitational Interaction of N Bodies
(2+2) Numerical Modeling of Solar System
(2+2) Complex Modeling of Multi-Body Problems (Part 1)
(2+2) Complex Modeling of Multi-Body Problems (Part 2)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">1. Actively participate in class by critically evaluating and arguing opinions, asking and answering questions.
2. Solve assigned problems in waves and optics.
3. Critically discuss selected concepts and laws and their applicability.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 2; Research: ; Practical work: 1.5
Experimental work: ; Paper:
Essay: ; Seminar paper: 1.5
Colloquiums: ; Oral exam:
Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The solutions to exercise tasks and the final seminar paper are being evaluated.</td></tr>
</table>

Required literature	Title	Number of copies available	Availability on other medium
	Harvey Gould, Jan Tobochnik, and Wolfgang Christian „An Introduction to Computer Simulation Methods Applications to Physical System“, Addison-Wesley, 2006.		
	A. B. Shiflet and G. W. Shiflet "Introduction to computational science", Princeton University Press, 2006.		
Supplementary literature	1) Numerical Recipes in C and C++, The Art of Scientific Computing, Press, Teukolsky, Vetterling and Flannery, Cambridge University Press, 1993. 2) An Introduction to Computational Physics, Tao Pang, Cambridge University Press, 2006.		
Quality assurance	1. Lecturers who have subjects with correlated learning outcomes work together to ensure quality of learning. 2. Statistics of test scores and assessment of performance in accordance with established learning outcomes. 3. Evaluation of students through an anonymous survey conducted in accordance with the regulations of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Statistics in research of education</td></tr>
<tr><td>ID</td><td>PMS171</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Anna Alajbeg</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 0
E: 15
P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The possibility of monitoring and understanding scientific literature and the personal use of statistics in quantitative educational research.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">No</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1.A qualification for making instruments, systematization, processing and presentation of quantitative data of the researched pedagogical phenomenon
2. Understanding of statistical data and their logic
3.Observation of descriptive indicators of the phenomenon and the causal relationships between phenomena
4. Qualification for monitoring educational periodicals</td></tr>
<tr><td>Syllabus</td><td colspan="3">1.Statistics and basic statistical concepts
2. Presentation of pedagogical
issues (labeling, grouping, presentation)
3. Measurement and
characteristics of normal distribution
4. - 8. Descriptive statistics
9. Calibration based on deciles and z-values
10.-14. Inferential statistics
15.Correlation</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Class attendance, preparation and presentation of the seminar paper, preliminary exams or oral exam (if student wants).</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>1</td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Class attendance and activity, the results of preliminary exams or written exam results or results of oral exam (if student wants).</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>1. Mejovšek, M. (2003.). Uvod u kvantitativne metode znanstvenog istraživanja u društvenim i humanističkim znanostima, Naklada Slap, Jastrebarsko.</td><td></td><td></td></tr>
<tr><td>2. Šošić, I. - Serdar, V. (2000.). Uvod u statistiku, Školska knjiga, Zagreb.</td><td></td><td></td></tr>
<tr><td>3. Gronlund, E. (1990.) Measurement and Evaluation in Teaching. Macmillan Pub.Co.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3">Consultations, discussion, active participation, evaluation.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3">*Contents are listed for academic block-hours (15 terms x 2 hours)
** Exercises are performed in groups (15x1 per group)</td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Natural Science and the Environment</td></tr>
<tr><td>ID</td><td>PMP162</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Ivana Weber</td><td>Points value (ECTS)</td><td>4.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 0
E: 10
P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">To understand and apply fundamental physical concepts, laws and approaches in physics and interdisciplinary with other disciplines on the environment.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">No</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">· Explain and apply the basic thermodynamics to the human environment
· Explain the basic composition, structure and dynamics of the atmosphere
· Explain the operation of the hydrologic cycle and discuss the mechanisms of water transport in the atmosphere and in the ground
· Discuss specific environmental problems such as noise pollution, ozone depletion and global warming in the context of an overall understanding of the environment and the application of the laws in physics
· Discuss the problems of energy demand and explain the possible contributions of renewables to energy sources
· Understand other environmental issues in relation to laws of physics (selected by students)</td></tr>
<tr><td>Syllabus</td><td colspan="3">(5) Application of the laws of thermodynamics
(5) Energy transfers
(2) Noise pollution
(2) Structure and comosition of the atmosphere
(2) Ozone in the atmosphere
(2) Greenhouse effect
(2) Earth radiation
(2) Global warming
(5) Water in the atmosphere and clouds
(5) Physics of wind creation
(2) Physics of ground
(2) Energy demand
(2) Renewable energy resources
(2) Selected topics</td></tr>
<tr><td>Teaching types</td><td>[x] Lectures
[x] Seminars
[x] Exercises
[ ] Fully online
[ ] Combined online</td><td>[ ] Fieldwork
[x] Individual assignments
[ ] Multimedia
[ ] Laboratory
[ ] Mentoring</td><td>[x] Predavanja korištenjem prezentacija i rasprava sa studentima.
[x] Rješavanje odabranih jednostavnih primjera, samostalno i u grupi,
[x] Studentske prezentacije i rasprave pojedinih tema na seminaru.
[ ]</td></tr>
<tr><td>Student obligations</td><td colspan="3">Active participation on classes and assignments.
Prepare and present a seminar on a selected topics
Solve the given numerical problems by using the concepts and laws from physics
Critically discuss selected concepts and laws and their applicability</td></tr>
</table>

Monitoring student work	Class attendance		Research		Practical work	
	Experimental work		Paper		aktivno sudjelovati u nastavi svojim komentarima, pitanjima i odgovorima na pitanja – pripremiti i prezentirati seminarski rad o odabranoj temi – riješiti zadane numeričke zadatke primijenjujući pojmove i zakone u navedenim sadržajima – kritički raspraviti odabrane pojmove i zakone te njihovu primjenjivost	2
	Essay		Seminar paper	2		
	Colloquiums		Oral exam			
	Written exam		Project			

Assessment and evaluation of student work	Preparation and presentation of seminars (50%) Critical discussion of concepts and laws (40%) Solve simple numerical problems (10%) The final grade is formed according to the following list: [50,60>% = D (2) [60,75>% = C (3) [75,90>% = B (4) [90,100]% = A (5)

Required literature	Title	Number of copies available	Availability on other medium
	Nigel Mason and Peter Hughes: Introduction to Environmental Physics: Planet Earth, Life and Climate, Taylor and Francis, 2001.		
	M. Dželalija, Environmental Physics, Skripta, 2004.		

Supplementary literature	Presentations, examples and course book, M. Dželalija By choice from various disciplines with topics on the environment
Quality assurance	– Analysis of achieved learning outcomes at the end of the class, compared to those at the beginning of the class – Monitoring the success of students in the following subjects – Other surveys of students according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Natural toxins in the sea</td></tr>
<tr><td>ID</td><td>PPC210</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Stjepan Orhanović</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 0, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Course objective is acquiring knowledge about various sources of toxicity originating in the sea and their influence on the human health</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon completing exam student will be able to:
1.recognize sources of toxicity in the marine environment
2.comprehend influence of the toxicity originating from phytoplanktons on the shellfish farming and humans
3.acquire insight in frequency and spatial distribution of the phytoplankton species responsible for shellfish intoxication in the Adriatic sea
4.know methods and techniques of analysis of the shellfish toxicity</td></tr>
<tr><td>Syllabus</td><td colspan="3">Lectures:
1.Eutrophication and the red tide (1 hour)
2.Phytoplankton species - producers (1 hour)
3.Diarrheic toxins (2 hours)
4.Paralytic toxins (2 hours)
5.Neurotoxins (2 hours)
6.ASP (2 hours)
7.Cyanotoxins, azaspiroid intoxication (1 hour)
8.Ciguatera intoxication (1 hour)
9.Analytical methods: Mousse bioassay, HPLC, mass spectrometry, MALDI-TOF (2 hours)
10.Overview of the present state in the Adriatic (1 hour)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring
☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending classes and preparing seminar as a PPT presentation.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 0.5; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper: 0.5
Colloquiums: ; Oral exam: 1
Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Power point presentation on the chosen subject with reflection on the causes, influence, frequency and spatial distribution of intoxication and related analytical methods</td></tr>
<tr><td>Required literature</td><td colspan="3">Title | Number of copies available | Availability on other medium
Scientific articles on the subject presented | | </td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3">Personal consultations, students survey for the evaluation of the subject and teacher, evidence of the presence on the classes.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Network Application Programming</td></tr>
<tr><td>ID</td><td>PMIC60</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>Dino Nejašmić, pred.</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 0
E: 30
P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">This subject begins with an in-depth study of XHTML, the universal language of the Web. CSS is studied as it relates to enhancing the presentation of web content. Client-side programming is taught using JavaScript and the DOM, technologies used to create dynamic content and provide a true interactive experience for the Web site visitor. Course continues by addressing the technical skills and business knowledge required to develop data-driven web sites hosted on the Microsoft Web Platform. The course continues to focus on server-side ASP.NET programming technologies and the C# language. Students work with current and full-featured data access technologies, and interact with a local database.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Basic knowledge of programming.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon successful completion of this subject students should be able to:
1. Analyze a given problem, and use JavaScript to program a browser-based solution to that problem.
2. Explain key design concepts essential to communicating with web site users.
3. Combine XHTML, CSS, and JavaScript to create dynamic web pages and integrated web sites.
4. Analyze the requirements for a web-enabled application, and use both ASP.NET and web client technologies to program a solution to the problem.
5. Use the design and productivity tools provided with Visual Studio
6. Design a suitable data access strategy, and use the appropriate technologies to work with the data</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Introduction to the Internet (2h)
2. Introduction to HTML/XHTML (2h)
3. Web Site Design (2h)
4. JavaScript (6h)
5. Dynamic Content with JavaScript (2h)
6. Midterm
7. ASP.NET technologies (2h)
8. ASP.NET user interface controls (2h)
9. Web applications (2h)
10. Data-driven web applications (2h)
11. Multilanguage support (2h)
12. Stored procedures in web applications (2h)
13. Security challenges in web application (2h)
14. Project (2h)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Lecture and laboratory attendance, active participation in course activities, homework and project realization, final exam.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1 | Research: | Practical work:
Experimental work: | Paper:
Essay: | Seminar paper:
Colloquiums: | Oral exam:
Written exam: 2 | Project: 2</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Attendance/Participation (20%)
Project (40%)
Final/Oral Exam (40%)</td></tr>
<tr><td>Required literature</td><td></td><td>Number</td><td></td></tr>
</table>

	Title	of copies available	Availability on other medium
	Osnove programiranja za web, Sveučilište u Splitu Filozofski fakultet, 2007. Lada Maleš, Saša Mladenović		
	JavaScript: The Definitive Guide, David Flanagan, O'Reilly (2011.)		
	Beginning ASP.NET 4.5 in C# Matthew MacDonald (2012.)		
Supplementary literature	Online Student material, including solutions to selected problems and additional reading		
Quality assurance	Student discussion, anonymous student evaluation questionnaire, student success rate, self-assessment		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="9">Programming paradigms</td></tr>
<tr><td>ID</td><td colspan="3">PMID45</td><td colspan="2">Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td colspan="3">Zoran Sambol</td><td colspan="2">Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td colspan="3" rowspan="2"></td><td colspan="2" rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td colspan="3">Compulsory</td><td colspan="2">Online percentage</td><td colspan="4">25%</td></tr>
<tr><td colspan="10">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="9">Adopt the basic knowledge of programming paradigms.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="9">Data structures and algorithms
Object-oriented programming</td></tr>
<tr><td>Learning outcomes</td><td colspan="9">To argument the advantages and disadvantages of a single programming paradigm.
To develop a simple program using different programming paradigms and languages.
To choose the appropriate programming paradigm in different usage contexts.
To argument advantages and disadvantages in using functional and imperative paradigms in concurrent program execution.</td></tr>
<tr><td>Syllabus</td><td colspan="9">Overview of programming paradigms with examples in an appropriate programming language.
Common properties of programming languages.
Imperative programming
Object-oriented programming - class based
Object-oriented programming - prototype based
Functional programming
Concurrent and imperative programming
Concurrent and functional programming
Logic programming
Best practice cases
Comparison of solutions in different programming paradigms on known problems</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☑ Combined online</td><td colspan="3">☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☑ Laboratory
☐ Mentoring</td><td colspan="3">☑ Homework assignments
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="9">Lecture and laboratory attendance, active participation in course activities, homework and project realization, final exam.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td>1</td><td colspan="3"></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Homework assignments</td><td>0.5</td><td colspan="3"></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Colloquiums</td><td>0.5</td><td>Oral exam</td><td>0.5</td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="9">Attendance/Participation (20%)
Project (40%)
Final/Oral Exam (40%)</td></tr>
<tr><td rowspan="2">Required literature</td><td colspan="5">Title</td><td colspan="2">Number of copies available</td><td colspan="2">Availability on other medium</td></tr>
<tr><td colspan="5">Robert W Sebesta, Concepts of Programming Languages, 10th Edition, Addison-Wesley, 2013</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Supplementary literature</td><td colspan="9">Bruce A. Tate, Seven Languages in Seven Weeks: A Pragmatic Guide to Learning Programming Languages, The Pragmatic Programmers, 2010</td></tr>
<tr><td>Quality assurance</td><td colspan="9">Student discussion, anonymous student evaluation questionnaire, student success rate, self-assessment</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="9"></td></tr>
</table>

Subject name	Applied spatial statistics		
ID	PMM501	Study year	2.
Lecturer	doc. dr. sc. Vesna Gotovac Đogaš	Points value (ECTS)	4.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description

Subject goals	The aim of the course is to introduce students with the fundamentals of statistical analysis for spatial data. The emphasis is on statistical analysis of real data examples using programming language R.
Enrolment requirements	The student must have completed the following course: Probability I Previous knowledge required: Students should have a basic background in statistics and programing.
Learning outcomes	1. Distinguish different types of spatial data, 2. determine which spatial methods to use to in their own research and implement them using statistical software R, 3. estimate parameters of different statistical models, 4. understand how spatial autocorrelation plays a role in statistical modelling and use existing methods to investigate spatial autocorrelation in example datasets provided.
Syllabus	Introduction. Examples of statistical problems in spatial data analysis. (2) Types of spatial data (4) Statistics of point processes. Estimation of characteristics. Hypothesis testing. Model parameter estimation. (8) Geostatistics. Estimation of variogram. Kriging. (8) Areal data. Parameter estimation. Spatial autocorrelation tests. (8)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Class attendance and taking partial and final exams.

Monitoring student work

Class attendance		Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	Partial exams, written exam and oral exam.

Required literature

Title	Number of copies available	Availability on other medium
Bivand R.S, Pebesma E.J., Gómez-Rubio V. : Applied Spatial Data Analysis with R. Springer Science&Business Media, 2008.		

Supplementary literature	Cressie N.A.C.: Statistics for Spatial Data. Wiley, 1993. Illian J., Penttinen A., Stoyan H., Stoyan D.: Statistical Analysis and Modelling of Spatial Point Patterns. Wiley, 2008. Moller J., Waagepetersen R. P.: Statistical Inference and Simulation for Spatial Point Processes. Chapman&Hall/CRC, 2003. Schabenberger O., Gotway C.: Statistical Models for Spatial Data Analysis. Chapman&Hall/CRC, 2005.
Quality assurance	Student evaluations following completion of the course. The evaluations are administered according to the regulations of the University of Split.

Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Educational Psychology 1</td></tr>
<tr><td>ID</td><td>PMS007</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Nikola Marangunić</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 15
E: 0
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Knowledge about elementary concepts from general and developmental psychology; better understanding of behavior, our own and others'.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">No</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon completion of the course students will be able to:
1. Interpret research methods and techniques in the field of education.
2. Explain core elements of human behavior: personality, intelligence, motivation and emotions.
3. Name basics of attitude development and life virtues.
4.Compare differences in psychological growth regarding life cycles: childhood, youth, maturity, old age</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Course introduction; 2. Introduction to Psychology of education; 3. Methodology in education research; 4. Personality – theories and models; 5. Personality – determinants and measuring; 6. Intelligence – definition and determinants; 7. Intelligence – measuring; 8. Motivation; 9. Emotions – types; 10. Emotions – development; 11. Attitudes – forming and influence of attitudes; 12. Attitudes – stereotypes and prejudice; 13. Attitudes – values and development of moral consciousness; 14. Psychological development – childhood and adolescence; 15. Psychological development – maturity and old age.</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☑ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring
☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending lectures, active participation, written seminar, midterm exams (optional).</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 0.5
Research:
Practical work:
Experimental work:
Paper:
Essay:
Seminar paper: 0.5
Colloquiums: 1
Oral exam: 1
Written exam: 1
Project:</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The presence and activity in class, midterm exam results (optional), course exam.</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>V. Andrilović, M. Čudina: Osnove opće i razvojne psihologije, Školska knjiga, Zgb,1985. 2</td><td></td><td></td></tr>
<tr><td>N. Pastuović: Osnove psihologije obrazovanja i odgoja, Znamen, Zgb.,1997</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">A. Fulgosi: Psihologija ličnosti – teorije i istraživanja, Školska knjiga, Zgb, 1981.
D. Goleman: Emocionalna inteligencija, Mozaik knjiga, Zgb., 1997.
D. Miljković, M.Rijavec: Razgovori sa zrcalom: psihologija samopouzdanja, Zgb., 1996.
M. Rijavec: Čuda se ipak događaju: psihologija pozitivnog mišljenja, IEP,Zgb., 1997.
Psihologijski rječnik, Prosvjeta, Zgb., 1992.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of</td></tr>
</table>

	Split
Other (in the opinion of the proponent)	Conversation, active participation, evaluation of subject and teacher.

<table>
<tr><td>Subject name</td><td colspan="3">Educational Psychology II</td></tr>
<tr><td>ID</td><td>PMS116</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Nikola Marangunić</td><td>Points value (ECTS)</td><td>3.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Adopting fundamental terms of memory and learning, recognizing students with special needs, perceiving elements of drug abuse.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Pass the Educational psychology I exam.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon completion of the course students will be able to:
1. Describe fundamental terms of human memory capabilities
2. Interpret theoretical preferences of learning mechanisms
3. Compare methods of evaluating student knowledge
4. Recognize and interpret special needs of students in school
5. Recognize different types of addiction and its prevention</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Course introduction;
2. Memory: types and processes;
3. Memory: phases and mnemonic techniques;
4. Memory: memory loss, proactive and retroactive inhibition
5. Learning: types;
6. Learning: elements of successful learning;
7. Learning: learning and memory;
8. Dokimology: theory and practical aspects of evaluating knowledge;
9. Dokimology: role of a teacher;
10. Dokimology: grading methods and exam anxiety;
11.Children with special needs in schools;
12. Criteria and types of special needs;
13. Drug abuse – addiction types;
14. Drug abuse – addictive behavior;
15. Methods of addiction prevention.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☑ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending lectures, active participation, written seminar, midterm exams (optional).</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>0.5</td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The presence and activity in class, midterm exam results (optional), course exam.</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Woolfolk, A. (2016): Edukacijska psihologija, Naklada "Slap", Jastrebarsko.</td><td></td><td></td></tr>
<tr><td>Grgin, T. (2004): Školsko ocjenjivanje znanja, Naklada "Slap", Jastrebarsko.</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Brdar, I., Rijavec, M. (1998): Što učiniti kad dijete dobije lošu ocjenu, IEP, Zagreb.
Čudina – Obradović, M. (1990): Nadrenost – razumijevanje, prepoznavanje i razvijanje, Školska knjiga, Zagreb.
Gossen, D. C. (1994): Restitucija – preobrazba školske discipline, Alinea, Zagreb.</td></tr>
</table>

	Janković, J. (1996): Zločesti Đaci genijalci, Alinea, Zagreb. Lalić, D., Nazor, M. (1997): Narkomani: smrtopisi, Alinea, Zagreb. Zarevski, P. (2007): Psihologija pamćenja i učenja, Naklada "Slap", Jastrebarsko. Vizek Vidović, V., Rijavec, M., Vlahović – Štetić, V., Miljković, D. (2003): Psihologija obrazovanja, IEP – Vern, Zagreb. Wood, D. (1995): Kako djeca misle i uče, Educa, Zagreb. Howe, M. J. A. (2002): Psihologija učenja. Naklada Slap, Jastrebarsko. Psihologijski rječnik (2005), Prosvjeta, Zagreb.
Quality assurance	Conversation, active participation, evaluation of subject and teacher.
Other (in the opinion of the proponent)	

Subject name	Psychology of self-confidence and positive thinking		
ID	PMS109	Study year	1.
Lecturer	doc. dr. sc. Nikola Marangunić	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 15, S: 15, E: 0, P: 0
Subject status	Elective	Online percentage	30%

Subject description

Subject goals	Introducing and facilitating students with themes from the field: self consciousness, social skills, communication issues, stereotypes, prejudice and tolerance.
Enrolment requirements	No
Learning outcomes	Upon completion of the course students will be able to: 1. Describe theoretical models of self confidence and self-esteem 2. Recognize self consciousness and problems in communication 3. Differentiate process of attitude development, stereotypes and prejudice 4. Describe danger of discriminating behavior 5. Interpret relation between positive thinking and tolerance
Syllabus	1. Course introduction; 2. Introduction to the field of self confidence psychology and positive thinking; 3. Dimensions and aspects of self consciousness; 4. Self-esteem; 5. Self confidence; 6. Normality and differences: criteria; 7. Stereotypes; 8. Prejudice; 9. Discrimination; 10. Tolerance: definition and types; 11. Tolerance towards people; 12. Development of tolerance; 13. Education on tolerance and positive thinking; 14. Positive thinking: self efficiency; 15. Positive thinking: optimism and hope.
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Attending lectures, active participation, written seminar.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	The presence and activity in class, seminar papers.

Required literature

Title	Number of copies available	Availability on other medium
Rijavec, M. i Miljković, D. (1997). Razgovori sa zrcalom: Psihologija samopouzdanja. IEP, Zagreb.		

Supplementary literature	1. Brdar, I., Rijavec, M. i Miljković, D. (2008). Pozitivna psihologija. IEP, Zagreb. 2. Krizmanić, M. (2009). Život s različitima. Profil International, Zagreb.
Quality assurance	Conversation, active participation, evaluation of subject and teacher.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="6">Computer vision</td></tr>
<tr><td>ID</td><td>PMII60</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Vladimir Pleština</td><td>Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Adopt basic knowledge about the elements of the system, algorithms and methods used in computer vision applications.
Independent student's ability to adapt and apply computer vision algorithms for specific problem.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Course enrolment requirements: none.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">After this course, students will be able to:
- Analyze and identify a given problem in the field of computer vision
- Classify algorithms of computer vision
- Identify the types of images
- Write algorithm for image processing in Python using OpenCV library
- Identify the method of processing for a given problem
- Apply the algorithm to its own problem</td></tr>
<tr><td>Syllabus</td><td colspan="6">An introductory lecture, introducing students to the rules of the class rules attendance, Introduction to the computer vision, an overview of the program, learning objectives and tasks of students. Introduction to literature
Introduction to Python and libraries that will be used. How to install plug-ins that are required for image processing.
Picture, cameras, models, calibration, perception of light

Exercise 1. Basic manipulation with images
The basic relations between the pixels, processing of binary images
Exercise 2. Advanced manipulation with images
The projections, length coding algorithms and binary (filter size, Euler number, the edge region, area, perimeter, compactness, transformation distance, the central axis, thinning, expansion and contraction)
Exercise 3. Mathematical operations on the image
Morphological operators, basic operations, dilation, erosion, closing, opening, binary morphology,
Exercise 4. Image processing
Improving the properties of gray images, the exponential transformation, histogram modeling, linear filters (convolution, filter spatial averaging, Gaussian filter, Median filter).
Exercise 5. Image derivation
Filtering in the frequency domain - Fourier transform
1st colloquium
Image segmentation
Exercise 6. Morphological operators - Objects labeling
Image segmentation - edge detection, gradient operators, operators of other derivatives, log detector edge, Canny edge detector
Exercise 7. Morphological operators - dilation, erosion, opening and closing
Textures and colors in images, color models, the physiology of the eye
Exercise 8. OpenCV
3D space points in 3D space, transformation of coordinate system, internal orientation and calibration
Exercise 9. OpenCV - Arithmetic operations on images
Objects in motion - detection of changes and segmentation based on changes
Exercise 10. OpenCV - Finding and marking objects
Objects in motion - tracking of moving objects
Exercise 11. OpenCV - Working with video
Object recognition
Exercise 12th OpenCV - Tracking objects
Student papers and the second colloquium</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures</td><td>☐ Fieldwork</td><td colspan="4"></td></tr>
</table>

	☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online	☑ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐
Student obligations	Class attendance Independently preparation of exercise. Making exercise reports Independent planning and presentation of student paper Active participation in the teaching process Exam.		

Monitoring student work	Class attendance	2	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	1		
	Colloquiums		Oral exam	2		
	Written exam		Project			

Assessment and evaluation of student work	Total scoring (100%): Exam or 2 colloquiums - 80%, student paper 10%, exercises 10% 1. Colloquium 1: 40% (or exam) 2. Colloquium 2: 40% (or exam) 3. Student paper: 10% (obligatory) 4. Excercises: 10% (obligatory) Rating by percentage: 50% to 62% - sufficient (2) 63% to 75% - good (3) 76% to 88% - very good (4) 89% to 100% - excellent (5)

Required literature	Title	Number of copies available	Availability on other medium
	Obrada slika i računalni vid, interna skripta.		
	Ramesh Jain, Rangachar Kasturi, Brian G.Schunck, Machine Vision, McGraw-Hill, 1995.		
	Prezentacije s predavanja		

Supplementary literature	1. Linda G. Shapiro, George C. Stockman, Computer Vision, Prentice Hall, 2001. 2. Wesley E.Snyder, Hairong Qi, Machine Vision, Cambridge University Press, 2004. 3. D.A. Forsyth, J. Ponce, Computer Vision A Modern Approach, Prentice Hall, 2003 4. Foley, Computer Graphics: Principles and Practice (second edition in C), Addison-Wesley Publishing Company, 1996.
Quality assurance	Conversation with the students. Students opinions about the quality of teaching through anonymous polls. The success of students at exam. Self-evaluation.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Computer Methods and Applications in Nano and Biophysics</td></tr>
<tr><td>ID</td><td>PMP409</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Vlasta Bonačić Koutecky</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 15, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Ability to model nanostructures and their properties for interpretation of experimental results and stimulation of new experiments.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Knowledge of classical physics and basics of quantum physics</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Selection of suitable methods for simulating system properties within nanophysics and biophysics
2. Independent evaluation and interpretation of results obtained by simulations
3. Comparison with experimental results
4. The skills to compare achievements in the relevant literature</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Basic theoretical methods for determining the structures and optical properties of molecules and nanoparticles
2. Their application for determining the optical properties of nano biomolecular hybrid systems
3. Fundamentals of molecular dynamics methods: ground and excited states for research of dynamic properties of molecules, nanoparticles and their hybrid systems
4. Application of molecular dynamics to determine the fluorescence of nano bio systems for biosensors
5. Simulation of catalytic properties of metal particles and applications for fuel cell improvement
6. Computational methods for structural and optical properties of two-dimensional periodic system and their use for improving the properties of materials for solar cells</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending lectures and exercises. Two tests (colloquia) from the material covered in the lectures. Written exam (a student who collects more than 50% of points from both colloquia is exempted from taking the written part of the exam). Oral exam. Preparation of the presentation of the selected scientific article.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>2</td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Two tests (colloquia) from the material covered in the lectures
Oral exam</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>F. Jensen: “Introduction to computational chemistry”, John Wiley and Sons, 2007. M.P.Allen, D.J.Tildesley: “Computer Simulationin Chemical Physics”, Kluwer Academic Publishers, 1993</td><td></td><td></td></tr>
<tr><td>Carsten A. Ullrich: „Time-Dependent Density-Functional Theory; Concepts and Applications“, Oxford Graduate Texts, 2011</td><td></td><td></td></tr>
<tr><td>M. P. Allen, D. J. Tildesley: “Computer Simulation in Chemical Physics”, Kluwer Academic Publishers, 1993.</td><td></td><td></td></tr>
</table></td></tr>
</table>

Supplementary literature	1.R. Mitrić, J. Petersen, V. Bonačić-Koutecký: Nonadiabatic Dynamics “on the fly” in Complex Systems and its Control by Laser Fields", in Conical Intersections II, Ed. by H. Köppel, W. Domckeand D. Yarkony, World Scientific 2011. 2.W. Domcke, D. R. Yarkony, H. Köppel Conical Intersections, World scientific Publishing, 2011 3.P. E. Hoggan, E. J. Brändas, J. Maruani, P. Piecuch, G. Delgado-Barrio Advances in the Theory of Quantum Systems in Chemistry and Physics, Springer, 2012 4.R. Antoine, V. Bonačić-Koutecký: Liganded Silver and Gold Quantum Clusters. Towards a New Class of Nonlinear Optical Nanomaterials, Springer, SpringerBriefs in Materials, 2018.
Quality assurance	An anonymous post-course survey will be used to identify weaknesses in course structure and performance. Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="4"></td></tr>
<tr><td>ID</td><td>PMIH12</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Monika Mladenović</td><td>Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6"></td></tr>
<tr><td>Enrolment requirements</td><td colspan="6"></td></tr>
<tr><td>Learning outcomes</td><td colspan="6"></td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="4">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6"></td></tr>
</table>

Monitoring student work						
	Class attendance		Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project			

Assessment and evaluation of student work			
Required literature	Title	Number of copies available	Availability on other medium
	–		
Supplementary literature			
Quality assurance			
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="6">Distributed systems</td></tr>
<tr><td>ID</td><td>PMIC50</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>Dino Nejašmić, pred.</td><td>Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Acquiring fundamental knowledge about distributed computing and related systems. Mastery of fundamental principles related to the application, validation and modelling of distributed systems.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">None</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. Enumerate the characteristics, advantages and shortcoming of distributed systems
2. Comprehend the software particularities of distributed systems
3. Understand various communication algorithms for distributed systems
4. Understand logical, vector and matrix clocks, along with the motivation behind them
5. Enumerate and comprehend ways for sharing resources and achieving mutual exclusion using various algorithms in a distributed system
6. Describe the peer-to-peer model</td></tr>
<tr><td>Syllabus</td><td colspan="6">Lecture on Introduction to distributed systems (2h), definition of distributed systems, advantages and shortcomings of distributed systems (2h), characteristics of distributed systems (2h), resource sharing (2h), hardware settings of distributed systems (3h), operating systems in distributed systems (3h), middleware programs (2h), communication in distributed systems (4h), logical, vector and matrix clocks (4h), mutual exclusion (2h), client-server model (2h), Peer-to-peer networks (2h). Laboratory exercises accompany the lecture topics with the same number of work hours.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="3">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="2">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Lecture and laboratory exercises attendance in accordance with the regulations on studying. The implementation of given laboratory exercises</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical work</td><td>1.5</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>2</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Class attendance (10%). Written/oral exam (by choice) (90%)</td></tr>
<tr><td rowspan="2">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">M. Van Steen, A. Tannebaum, Distributed Systems: Principles and Paradigms, Prentice Hall</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">R. Orfali, D. Harkley, J. Edwards: The Essential Distributed Object Survival Guide, John Wiley</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Student consultations, anonymous student survey, exam success, self-analysis</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

Subject name	Development and optimization analytical chemical methods		
ID	PPC221	Study year	3.
Lecturer	doc. dr. sc. Ivana Mitar	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 30, P: 0
Subject status	Elective	Online percentage	40%

Subject description

Subject goals	Acquire, understand, and apply basic theoretical knowledge of analytical chemistry using classical qualitative and quantitative methods of physicochemical analysis and instrumental methods for solving the problematic task of investigation.
Enrolment requirements	
Learning outcomes	The student is enabled to: 1.distinguish between quantitative and qualitative methods of analysis, 2.participate in the selection of the appropriate method of analysis according to the nature of the samples and the parameters of the investigation, 3.determine an appropriate method to solve a problem, and 4.perform the experimental part of the investigation independently and participate in the interpretation of the results of the analysis.
Syllabus	The student chooses one of the problematic research tasks offered within the framework of analytical or instrumental methods of analysis. The task may be part of an ongoing scientific study or the development of analytical methods about which the student already has knowledge or experience, as an entry into a scientific thesis or dissertation. Under the supervision of the mentor, the student independently researches a literature review, sampling, method establishment, sample preparation and measurement, and interpretation of results. Upon completion of the experimental work, the student is required to write a detailed report on the experiment provided.
Teaching types	☐ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☑ Mentoring
Student obligations	Students are required to participate in the teaching process actively. These will be recorded and evaluated when making the final grade

Monitoring student work

Class attendance		Research	0.5	Practical work	
Experimental work	1.0	Paper			
Essay		Seminar paper	0.5		
Colloquiums		Oral exam			
Written exam		Project			

Assessment and evaluation of student work	Practical work will be evaluated upon completion of the experimental section based on the student's dedication, effort, and independence from reviewing the literature to describing the experiment and results in a written report. The final grade will be based on the grade of the practical part, the written report, and/or oral presentation.

Required literature

Title	Number of copies available	Availability on other medium
D. C. Harris, Quantitative Chemical Analysis, W. H. Freeman and Company, 41 Madison Avenue New York, NY, 2016.		
R. Kellner, J. M. Mermet, M. Otto, M. Valcarcel and H. M. Widmer, Analytical Chemistry (A Modern Approach to Analytical Science, Second Edition), Wiley-VCHVerlag Gmbh & Co. KGaA, Weinheim, 2004.		
B. M. Tissue, Basic of Analytical Chemistry and Chemical Equilibria, John Wiley & Sons, Inc., Hoboken, New Jersey,		

	NY, 2013.		
	D.A. Skoog, D.M. West, F.J. Holler, Osnove analitičke kemije, Školska knjiga Zagreb, 1999.		
Supplementary literature	On-line databases		
Quality assurance	The monitoring of the quality and success of teaching and the acquisition of knowledge (skills) is monitored at the level of (1) teachers, accepting suggestions from students and colleagues, and (2) faculty, conducting student surveys on the quality of teaching.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Symmetries in Physics</td></tr>
<tr><td>ID</td><td>PMP274</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Toni Šćulac
prof. dr. sc. Ilja Doršner</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30 | S: 0 | E: 30 | P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>5%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The course objective is to introduce students to the methods of group theory in order to describe and study symmetries of physical systems.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon succesful completion of the course a student will be able to:
1. define basic concepts of group theory;
2. name the most common finite and continous groups;
3. implement the tools of group theory to decompose reducible representations of finite groups into irreducible ones;
4. find direct product of representations of Lie groups;
5. explain the connection between permutation groups and representations of unitary groups;
6. describe Lorentz group and its representations.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Symmetries of physical systems, laws of conservation, classification of states. Group theory basics. Group axioms, generators and defining relations, Cayley's tables, subgroups, Lagrange's theorem.
2. Normal subgroups, quotient-groups. Equivalence relations, conjugation classes. Group representations. Dihedral group.
3. Group morphisms. Direct sum and direct product, semidirect group product. Projection operators. Schur's lemma. Representation operations.
4. Characters of representations. Representations of direct group product. Permutation group - cycles, transpositions, and conjugation classes. Permutation group representations.
5. Permutation group algebra. Quantum mechanics examples: n-electron systems. Building up of antisymmetric wave functions out of the spacial and spin wave functions.
6. Young tableaux.
7. Continous groups and associated representations. Lie groups, continuity and analyticity of structure functions.
8. Examples of Lie groups in physics. Properties of Lie algebras - SO(n) and SU(n).
9. Lie group representations and Lie algebras, structure constants. Ireducibile representations of Lie algebra of group of rotations. Canonical basis. Casimir operator.
10. Direct product of representations of Lie group - operators, matrice, and generators. Decomposition of direct product into ireducibie representations for SU(2) group. Clebsch-Gordan coefficients.
11. Weight diagrams. (Selection rules. Ireducibile tensor operators, Wigner-Eckart theorem.) Unitary group in particle physics. Isospin, SU(2) group. Hypercharge, SU(3).
12. Representations of unitary groups, connection to permutation group, Young tableaux.
13. Lorentz group and its representations. Homogenous and inhomogenous Lorentz transformations. Properties and ireducibile representations of Lorentz and Poincaré groups. Connection to classical and quantum fields.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Lecture attendance >70%;
Excercises attendance >70%.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 2 | Research: | Practical work:
Experimental work: | Paper: | Independent work: 2.7</td></tr>
</table>

	Essay		Seminar paper			
	Colloquiums	0.2	Oral exam	1		
	Written exam	0.1	Project			
Assessment and evaluation of student work	Two tests (midterm exams). Final exam.					
Required literature	**Title**	**Number of copies available**	**Availability on other medium**			
	H. F. Jones, Groups, Representations and Physics, 2 nd edition, IOP Publishing, 1998					
	J. F. Cornwell, Group Theory in Physics, An Introduction, Academic Press, 1997					
Supplementary literature	W. Greiner, B. Müller, Quantum Mechanics – Symmetries, Second Edition, Springer Verlag, 1994 M. Hamermesh, Group Theory and Its Application to Physical Problems, Dover, 1989					
Quality assurance	Evaluation of examination results and the course evaluation via anonymous student evaluation at the end of the course. Anonymous evaluation will be conducted following the rules of University of Split.					
Other (in the opinion of the proponent)						

Subject name	Sociology of Education						
ID	PMS108	Study year	1.				
Lecturer	Antonija Bašić, pred.	Points value (ECTS)	2.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			15	15	0	0	
Subject status	Elective	Online percentage	0%				

Subject description	
Subject goals	The main objectives of the course is to familiarize students with the basic objectives, concepts, development, theoretical, social context, the specifics of educational institutions and the position and relations of participants in them.
Enrolment requirements	No.
Learning outcomes	After passing the exam each student should be able to: 1. ...describe and to define what is the subject of sociology of education, including beginnings ant the evolution of the discipline, its main basic terms of, its position and value among other sciences); 2nd ...explain wider social context of the education - values provided, a wide range of social relationships within, its social functions, a question of the social un /equality as a consequence of the education, the importance of the education in the modern and the post-modern society; to explain especially the processes that affect process of the education, eventually, the final success and competences of students; as well as specific internal dynamics, its characteristics, problems and deviations of the system itself, etc.); 3rd ... identify the three main sociological (theoretical) perspectives concerning the education-training (basic settings, advantages / disadvantages); 4th ...identify the impact of outer social and technological changes on the development of the education, also concerning education in correlation to the other social phenomena (democratization, multiculturalism, globalization, ecology, technology); 5th ...understand the importance of the role of educators / teachers in today’s society (the characteristics of their profession); 6th ...demonstrate the presentation of educational content of the course.
Syllabus	1. Introduction to Sociology of Education (2 hours) 2. Analysis and explanation of basic concepts (2 hours) 3. Introduction to the historical development of Sociology of Education - the formation, development, scope and tasks; relationship to other sciences (4 hours) 4. Theoretical perspectives of Sociology of education and education□functionalism, conflict theory perspective, interactionism (4 hours) 5. Social inequalities and educational opportunities (2 hours) 6. Changes in the structure and role of the family and education (2 hours) 7. Education and social change - social values; - Socialization and deviant phenomena; Sociology of the profession educator and teacher profession (2 hours) 8. The social context of education (4 hours) 9. The Sociology of the profession teacher and educater (2 hours) 10.The institutional system of education in Croatia (2 hours) 11. Ecology and education (2 hours) 12.New trends (2 hours)
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Class attendance , seminar paper, active participation.

Monitoring student work						
	Class attendance	1	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	1		

	Colloquiums	2	Oral exam			
	Written exam		Project			
Assessment and evaluation of student work	Class attendance 10% Preliminary exam 70% Seminar paper 15% Activity 5%					

Required literature	Title	Number of copies available	Availability on other medium
	Cifrić, I. (1990). Ogledi iz sociologije obrazovanja. Zagreb: Školske novine (prva tri poglavlja).		
	Haralambos, M., Holbron, M. (2002).Sociologija: Teme i perspektive. (str. 773-882). Zagreb: Golden marketing.		
	Pilić, Š. (2008.), /ur./, Obrazovanje u kontekstu tranzicije. Split: HPKZ, str. 45-57; 59-66; 129-145; 149-162; 165-174; 239-244.		
	Vujević, M. (1991). Uvod u sociologiju obrazovanja. Zagreb: Informator. str. 4-5; 21-48.		

Supplementary literature	Bognar, B. Škola na prijelazu iz industrijskog u postindustrijsko društvo. Metodički ogledi 10(2): str. 9-24 Farnell, T (2009) Jamči li besplatno obrazovanje i jednak pristup obrazovanju. Revija za socijalnu politiku (god.16 br.2) Piršl, Temeljni pojmovi odgoja, http://209.132/search?q=cache:wtj7xGc4SUIJ.www.ffpu.hr/fileadmin/Documenti/Odgoj_02.ppt+odgoj+definicija&cd=3&hl=en&ct=clnk, 29.1.1020. Ross, A. (2009), Educational Policies that Address Social Inequality: Overall Report. Dostupno na: http://www.epasi.eu
Quality assurance	• Evaluation of results in accordance with the above learning outcomes • Feedback from students via surveys • Self-evaluation of teachers • Institutional and non-institutional evaluations
Other (in the opinion of the proponent)	No.

<table>
<tr><td>Subject name</td><td colspan="6">Sociology of science</td></tr>
<tr><td>ID</td><td>PMS111</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Vlaho Kovačević
Antonija Bašić, pred.</td><td>Points value (ECTS)</td><td colspan="4">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>15</td><td>15</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">1. To present the content of the course in Sociology of science
2. To explain the occurrence and development of Sociology of science
3. To explain wider social context of science and the function of it in society, as well as its place in social structure
4. To critically and creatively analyse science-society relationship, as well as functions of science
5. To notice the impact of science on development of society, and vice versa, i.e. how society influences development of science
6. To describe basic features of social structure of science (scientist, scientific work, relationships and groups in science, scientific institutions and social constructs)
7. To notice and describe connection between sociology of science and other culture components and forms of cognition
8. To critically think about internal and cognitive approaches to science
9. To notice the impact of social and scientific factors interaction in a certain historical period
10. To critically and creatively think about the idea of science and social circumstances</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">After passing the exam successfully, students will be able to:
1. explain the content of the course in Sociology of science and basic duties of Sociology of science
2. explain occurrence and development of Sociology of science as a complex result of interaction of economic, political, moral and practical problems of scientific cognition, as well as the impact of science on those
3. explain social functions of science and their place in social structure
4. critically and creatively think, to stimulate interest, motivation and discussion on different impacts of society on science, and impacts of science on society
5. construct a systematic theoretical knowledge about the impacts of society on science, and impacts of science on society
6. explain how social structure of science contributes to, directs (or blocks) development of science
7. understand the purpose of culture within various forms of cognition as a wide research area of Sociology of science
8. explain why internal or cognitive approach to science, where social circumstances are incidental, is not sufficient
9. engage in social researches of science
10. explain the significance of society-science relationship as a cultural tradition</td></tr>
<tr><td>Syllabus</td><td colspan="6">1. Introductory lecture: Where does science go? Introduction of the programme / giving out the topics for seminar papers
2. The concept and the object of Sociology of science
3. The occurrence and the development of Sociology of science (I)
4. The occurrence and the development of Sociology of science (II)
5. Basic social functions of science
6. Science and other social subsystems
7. Statistic researches on science
8. Social structure of science (the position of a scientist)
9. Social structure of science (scientific work)
10. Social structure of science (relationships and groups in science) I
11. Social structure of science (relationships and groups in science) II
12. Scientific communities and institutions
13. Scientific constructs</td></tr>
</table>

	14. Impact of different elements of science structure on development of society 15. Impact of scientists in society and impact of society structure on development of science
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Class attendance
Assessment and evaluation of student work	Class attendance, class participation, test results, seminar paper results, exam results (if students take the exam).

Monitoring student work

Class attendance		Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1		
Colloquiums	1	Oral exam			
Written exam		Project			

Required literature

Title	Number of copies available	Availability on other medium
.Bucchi, M. (2004). Science in Society. An introduction to Social Studies of Science, London: Routledge (prvo poglavlje od str. 7-23 i sedmo poglavlje od str. 107-123).		
Ben, D. (1986). Uloga znanstvenika u društvu, Zagreb: Školska knjiga. (uvod, predgovor, prvo i drugo poglavlje od str. 5-52 i deveto zaključno poglavlje sa dodatkom od str. 208-240).		
Bjelajac, S. (2003). Znanost i društvo, Split: Skripta za studente fizike-informatike, matematike-fizike, fizike-tehničke kulture i informatike-tehničke kulture. (1-202)		

Supplementary literature

1. Habermas, J. (1986). Tehnika i znanost kao ideologija. Zagreb: Školska knjiga. (53-87).
2. Hagstrom, W. (1974). Competition in science, The American Journal of Sociology 39 (1): 1-18.
3. Horgan, J. (2001). Kraj znanosti, Zagreb: Jesenski i Turk. (49-68)
4. Matić, D. (1999). Internalizam racionalnih metodologija i eksterno-socijalna povijest
znanosti: argumenti u prilog sociologije znanstvenog znanja. Revija za sociologiju 30 (1-2): 81-98.
5. Matić, D. (2001). Ratovi znanosti: pogled unatrag, Zagreb: Naklada Jesenski i Turk.
6. Milić, V. (1977). Nastajanje sociologije nauke, Sociologija 19 (1): 5-67.
7. Milić, V. (1986). Sociologija saznanja, Sarajevo: Veselin Masleša. Društvene funkcije ideja i znanja. (487-544).
8. Milić, V. (1995). Sociologija nauke: Razvoj, stanje, problemi, Novi Sad: Odsek za filozofiju i sociologiju Filozofskog fakulteta u Novom Sadu; Veternik: LDI. (143-228).
9. Needham, J. (1984). Kineska znanost i Zapad: velika titracija, Zagreb: Školska knjiga. (17-55).
10. Polšek, D. (ur.) (1998). Vidljiva i nevidljiva akademija. Mogućnosti društvene procjene znanosti u Hrvatskoj, Zagreb: Institut društvenih znanosti.
133 Preddiplomski sveučilišni studij Fizika
11. Popović, D. (2012). Žene u nauci: od Arhimeda do Anštajna, Beograd: Službeni glasnik.
12. Popović, M. (1988). Problemi društvene strukture. Beograd: Naučna knjiga. (Priroda socijalnog determinizma i njegove teorijske pretpostavke, Društvena djelatnost i njene sociološke karakteristike, Društveni odnosi i njihova sociološka obilježja, Društvene grupe).
13. Prpić, K. (1996). Produktivnost istaknutih znanstvenika: znanstvena vrsnost i

	socio-kognitivni kontekst, Revija za sociologiju 27(1-2): 37-52. 14. Prpić, K. (1997). Profesionalna etika znanstvenika, Zagreb: Institut za društvena istraživanja. 15. Prpić, K. (2005). Elite znanja u društvu (ne)znanja, Zagreb: Institut za društvena istraživanja. (185-321). 16. Prpić, K. (2008). Onkraj mitova o prirodnim i društvenim znanostima, Zagreb: Institut za društvena istraživanja. (9-80, 163-189) 17. Sal Restivo. (1994). Science, Society, and Values: toward a sociology of objectivity, London AND Toronto: Associated University Presses. (prvo poglavlje). (PDF) 18. Skledar, N. Kregar, J. (2003). Znanost o društvu, Osnovni pojmovi i razvoj, Zaprešić: Visoka škola. (26-48). 19. Škorić, M. (2010). Sociologija nauke: mertonovski i konstruktivistički programi, Sremski Karlovci, Novi Sad: izdavačka knjižarnica Zorana Stojanovića. (142- 196). 20. Ule, A. (1996). Znanost i realizam, Zagreb: Hrvatsko filozofsko društvo.
Quality assurance	Office hours, discussion, active participation, class and teacher evaluation.
Other (in the opinion of the proponent)	No.

<table>
<tr><td>Subject name</td><td colspan="3">Specijalna mikrobiologija</td></tr>
<tr><td>ID</td><td>PMB282</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Ana Maravić</td><td>Points value (ECTS)</td><td>2.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15
S: 0
E: 15
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Osposobljavanje studenata za razumijevanje temeljnih spoznaja o biologiji bakterijskih, virusnih, gljivičnih i parazitskih patogena koji uzrokuju infektivne bolesti, njihovim mehanizmima širenja i prijenosu, patogenezi, kontroli i prevenciji kao i za razvoj informatičkih i dijagnostičkih vještina, uključujući korištenje i tumačenje laboratorijskih testova u dijagnosticiranju uzročnika bolesti, te savladati vještine determinacije i mikroskopske analize.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Opća mikrobiologija</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1.Izraditi bazu znanja o načelima mikrobne taksonomije, strukture, fiziologije funkcija.
2.Opisati, povezati i kritički analizirati osnovne spoznaje o patogenezi mikroorganizama i nastanku infektivnih oboljenja.
3.Analizirati spoznaje o značaju ekologije i evolucije u širenju zaraznih bolesti.
4.Primijeniti vještine mikroskopske analize, kolonijalne morfologije i biokemijskih obilježja u determinaciji patogena.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Predavanja:
1. Gram pozitivni koki – rodovi Streptococcus, Staphylococcus, Enterococcus. (1,5 sat)
2. Gram negativni koki– rodovi Neisseria, Moraxella, Haemophilus, Bordetella, Legionella, Brucella, Pasteurella i Francisella. (1,5 sat)
3. Osnovna obilježja bakterija iz porodice Enterobacteriaceae (1,5 sat)
4. Gram negativne, zavijene, štapićaste bakterije – Vibrio, Helicobacter, Campylobacter i Gram- negative nefermentativne bakterije – rodovi Pseudomonas, Acinetobacter. (1,5 sat)
5. Acidorezistentne bakterije, rod Mycobacterium i Nocardia i Gram- negativne spiralne bakterije, porodica Spirochaetaceae. (1,5 sat)
6. Bakterije bez stanične stijenke, porodica Mycoplasmataceae. Obligatne unutarstanične bakterije ¬ Rickettsiaceae, Chlamydiaceae. (1,5 sat)
7. Osnovna obilježja virusa: Sastav i struktura virusa: Virion, kapsida, nukleokapsida, kapsomera, helikalna i ikosaedralna i kompleksna simetrija virusa. (1,5 sat)
8. Životni ciklus virusa. Virusne infekcije. (1,5 sat)
9. Uvod u mikologiju. Strukture stanica gljiva. Raznolikost gljiva: kvasnice i plijesni. (1,5 sat)
10. Uvod u medicinsku parazitologiju. Crijevne protozoe. Krvni i tkivni paraziti. (1,5 sat)
Laboratorijske vježbe uključuju:
Identifikaciju mikroorganizama na temelju mikro i makromorfologije, fizioloških, biokemijskih obilježja glavnih skupina bakterija, gljiva, virusa i protozoa.
Gram pozitivni koki – rodovi Streptococcus, Staphylococcus, Enterococcus. Rodovi – Neisseria, Moraxella, Haemophilus, Bordetella, Legionella. Brucella, Pasteurella, Francisella. Značajke bakterija iz porodice Enterobacteriaceae.
Gram negativne, zavijene, štapićaste bakterije-Vibrio, Helicobacter, Campylobacter. Gram- negative ne fermentirajuće bakterije – rodovi Pseudomonas, Acinetobacter. Anaerobne bakterije-rodovi Clostridium, Lactobacillus, Actinomyces; porodica-Bacteroideaceae. Gram pozitivni bacili: rodovi Bacillus, Corynebacterium, Listeria. Acidorezistentne bakterije, rod Mycobacterium i Nocardia. Gram- negativne spiralne bakterije, porodica Spirochaetaceae. Bakterije bez stanične stijenke, porodica Mycoplasmataceae. Obligatne unutarstanične bakterije: Rickettsiaceae, Chlamydiaceae. Dermatofiti-Trichophyton, Microsporum, Epidermophyton. Dimorfne gljive. Pneumocystis. Mikro i makromorfologija plijesni.
Uvod u medicinsku parazitologiju. Crijevne protozoe. Krvni i tkivni paraziti. Helmintologija. Cestode. Trematode. Nematode.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises</td><td>☐ Fieldwork
☑ Individual assignments
☑ Multimedia</td><td>☐
☐</td></tr>
</table>

	☐ Fully online ☐ Combined online	☑ Laboratory ☐ Mentoring	☐ ☐
Student obligations	Nazočnost na predavanjima u iznosu od najmanje 70% predviđene satnice. Obavljene sve predviđene laboratorijske vježbe, seminarski rad i projekt.		

Monitoring student work						
	Class attendance	0.5	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper	0.5		
	Colloquiums	0.5	Oral exam	1		
	Written exam	0.5	Project			

Assessment and evaluation of student work	Konačna ocjena studenta će se bazirati na temelju ostvarenih rezultata u kombinacijipredavanja, seminara, laboratorijskih vježbi i projekta. Ispit se sastoji od pismenog i usmenog dijela. Gradivo predmeta podijeljeno je na dvije cjeline koje studenti polažu preko parcijalnih pismenih ispita ili pak pristupanjem cjelokupnom ispitu na kraju semestra. Pismeni ispit se smatra položenim ukoliko studenti postignu najmanje 50% od ukupnog broja bodova. Nakon položenog pismenog dijela student stiče pravo izlaska na usmeni dio ispita. Konačna ocjena formira se temeljem ocjena iz pismenog i usmenog dijela ispita. Bodovanje: <50% student nije zadovoljio; 50-60% dovoljan (2); 60-70% dobar (3); 70-85% vrlo dobar (4); 85-100% izvrstan (5).

Required literature	Title	Number of copies available	Availability on other medium
	S. Kalenić, E.Mlinarić-Missoni i sur.: Medicinska bakteriologija i mikologija. Udžbenik, “Merkur A.B.D.”, Zagreb.		
	B. Richter: Parasitologija. Udžbenik, “Merkur A.B.D.”, Zagreb, 2002.		e-portal
	V. Presečki i sur.: Medicinska virologija. Udžbenik, Medicinska naklada, Zagreb, 2002.		
	Interni materijali s predavanjima i protokolima praktikuma (CD)		e-portal

Supplementary literature	Jawetz, Melnick, & Adelberg's Medical Microbiology. Eds. G.F.Brooks, J.S.Butel, S.A. Morse, 22nd Edition, Lange Medical Books/McGraw-Hill, New York, Chicago, San Francisco, Lisbob, London, Madrid, Mexico City, Mlan, New Delhi, San Juan, Seoul, Singapore, Sydney, Toronto, 2004.
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

Subject name	Statistical Physics		
ID	PMP115	Study year	3.
Lecturer	izv. prof. dr. sc. Larisa Zoranić	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 15, E: 15, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description	
Subject goals	Understanding the behavior of systems of many particles through thermodynamic principles and statistical physics.
Enrolment requirements	Passed courses in General Physics, Modern Physics, Mathematics and attended introductory courses in statistical physics and classical mechanics.
Learning outcomes	After successfully completing the course, the student will be able to: 1. To connect thermodynamics and statistical physics for the purpose of explaining physical henomenon in many-particle systems. 2. Formulate and apply ensemble theory to various physical systems. 3. Derive Liouville's theorem and discuss the ergodic hypothesis. 4. Analyze the properties of bosonic systems of many particles. 5. Analyze the properties of fermionic systems of many particles. 6. Analyze phase transitions and critical phenomena. 7. Discuss the concept of Brownian motion and diffusion processes. 8. Discuss the interrelationships of fluctuations, dissipation and macroscopic irreversibility.
Syllabus	The timetable worked out according to the weekly plan: 1. Introduction to the course. Statistical ensembles. Density function and probability density. Microcanonical and canonical ensemble. The ergotic hypothesis. Liouville's theorem. 2. Grand canonical ensemble. Grand canonical potential. Fluctuation of the number of particles. Chemical reactions. 3. Thermodynamic description of classical models (polymer, "zipper" model, two-state model, ideal gas) in different ensembles. 4. Comparison of classical and quantum approaches. Symmetric and antisymmetric states. Factor N! Density of states. Quantum distributions. 5. Fermi-Dirac distribution. An ideal fermionic gas at low temperatures. 6. Fermi energy. Sommerfeld expansion. 7. Bose-Einstein distribution. An ideal bosonic gas. 8. Blackbody radiation through Bose-Einstein statistics. Bose-Einstein condensation. 9. Thermodynamics and statistical mechanics of magnetism. 10. First-order phase transitions. Phase stability conditions. Clausius-Clapeyron relation. Second-order phase transitions. Van der Waals model. 11. Behavior near the critical point. Critical exponents. 12. Ising model. Mean field theory. Scaling. 13. Stochastic processes. Description of Brownian motion and diffusion. Einstein-Smoluchowski equation. 14. Langevin equation. Fokker-Planck equation. 15. Fluctuations and non-equilibrium processes. Fluctuation-dissipation theorem.
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	

Monitoring student work						
Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	1	Oral exam	2		
Written exam		Project			

Assessment and evaluation of student work	Knowledge is tested by a written and oral exam. Colloquiums are organized during classes. Students who do not pass the written part through the colloquium have 4

	additional exam deadlines for passing the written part. The oral exam is taken after the written part.

Required literature	Title	Number of copies available	Availability on other medium
	Statistical mechanics-3rd ed. R. K. Pathria, Paul D. Beale, 2011 Elsevier Ltd.		online
	Elementary Statistical Physics, C. Kittel, Dover Publications, 2004		online
	Statistical physics, D. Sunko online script		on

Supplementary literature	Introduction to Statistical Physics, Kerson Huang, Taylor and Francis, 2001. K. Dill and S. Bromberg, Molecular Driving Forces: Statistical Thermodynamics in Biology, Chemistry, Physics, and Nanoscience, Garland Science; 2nd edition (2010) Feynman, The Feynman Lectures on Physics, (Chapters 39-46), 1963. Scientific articles, lectures
Quality assurance	The success of the program is monitored by the quality of knowledge demonstrated in the exams as well as by assessing the enthusiasm shown for the subject. External evaluation includes student surveys. Statistics of exam results and student evaluation through an anonymous survey on at the end of the course performance. The survey is conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">STATISTICS</td></tr>
<tr><td>ID</td><td>PMM861</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Vesna Gotovac Đogaš</td><td>Points value (ECTS)</td><td>4.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>60%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Ensure that, through selected topics, students acquire knowledge of basic notions, concepts and methods in statistics on the level that is satisfactory for everyday use and for understanding the application of statistics in undergraduate and graduate courses on a life science curriculum. The emphasis is on understanding, appropriate interpretation of data, and on performing a simple statistical analysis. The selected elements of statistical inference form a basis for further comprehension and application of more sophisticated statistical procedures. Students are instructed on how to use one statistical software package ("R", at present).</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Elementary knowledge of calculus and operations with sets.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon successful completion of the course student should be able to
carry out a simple statistical data analysis;
interpret the output of a simple statistical data analysis;
recognize and apply the most frequently used discrete and continuous probability distributions;
estimate different level confidence intervals of a population parameter;
comprehend the idea of statistical testing;
apply a few well-known statistical tests.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Introduction. Descriptive statistics: graphical visualising of data, measuring center, spread, location and shape. (8 hours)
Sample space, classical and statistical definition of probability, probability space. Combinatorial rules. (3 hours)
Conditional probability, independent events and Bayes' rule. (2 hours)
Discrete random variable, probability distribution and (cumulative) distribution function; parameters. Bernoulli, binomial, (hyper)geometric and Poisson random variable. (4 hours)
Continuous random variable, probability density function and (cumulative) distribution function; parameters. Uniform, exponential, chi-square, normal and (Student's) t-distribution. Central limit theorem. (4 hours)
Two-dimensional random variable. Linear regression and correlation. (3 hours)
Estimation of parameters, confidence intervals. (2 hours)
Statistical testing a hypothesis. Parametric and non-parametric tests. (4 hours)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending lectures and exercises and taking exams.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance 1.2 | Research | Practical work
Experimental work | Paper
Essay | Seminar paper
Colloquiums 1.4 | Oral exam 0
Written exam 1.4 | Project</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Monitoring and grading students' achievements lasts throughout the semester. Students are assigned homework individually. The exam comprises two partial written tests and a final written test. So as to pass the exam, the summarized score should be at least 50%.

Students whose summarized score is less than 50% are admitted to take a "classical" exam in two autumn exam terms. Such an exam consists of a written and an oral part, both equally weighted in the final grade. Passing written test (score $\geq$50%) is a</td></tr>
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<tr><td></td><td colspan="3">necessary condition for taking up an oral exam.</td></tr>
<tr><td rowspan="3">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Lecture notes in the form of slides (T. Vučičić)</td><td></td><td></td></tr>
<tr><td>Lecture notes in the form of a book (A. Vukelić, Faculty of Food Technology and Biotechnology)</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">N. Koceić Bilan, Primijenjena statistika, skripta, PMF Split, 2012.
D.S. Moore, G.P. McCabe, B.A. Craig, Introduction to the Practice of Statistics, 6th edition, W. H. Freeman and Co., N.Y., 2009.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Exam results statistics. Students' quality assessment at the end of the semester carried out by the University authorized committee through anonymous polls.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	STATISTICS IN COMPUTER SCIENCE		
ID	PMM911	Study year	1.
Lecturer	dr. sc. Ana Perišić	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	30%
Subject description			
Subject goals	An introduction to fundamental statistical concepts and classical methods of statistical analysis; preparing students for independent statistical analysis and the acquisition of basic skills of using statistical software packages.		
Enrolment requirements	Introduction to probability and statistics.		
Learning outcomes	Students will be able to: conduct descriptive statistical analysis select and apply statistical models for practical problems in a wide range of areas and assessing their suitability estimate statistical parameters and calculate the standard error construct confidence intervals understand concepts of statistical testing and to perform statistical tests perform a linear regression analysis and correctly interpret the parameters demonstrate and prove mathematical statements related to statistical theory covered by this college use computer tools for creating reports, graphical and tabular presentation of results, and generally to support statistical analysis critically analyze new literature for data analysis		
Syllabus	Lectures/Exercises (2h/2h): Introduction. Descriptive statistics: statistical data, classification, frequency distributions, discrete and continuous distributions, tabular and graphical representation. Descriptive statistics: measures of central tendency, arithmetic mean, geometric mean, harmonic mean, median, mode, quantiles. Measures of dispersion: range, interquartile range, standard deviation. Box-plot, Chebyshev Inequality, moments, standardization, measures of symmetry and peakedness. Bivariate frequency distribution, contingency table. Marginal distribution. Conditional distribution. Statistical independence. Random variables, discrete and continuous random variables functions of random variables. Joint distributions. Conditional distributions. Independance. Expectation, variance and covariance.Conditional expectation. Central limit theorem. Sampling. Population , sample. Population parameter , statistic. Simple random sampling (with/without replacement, finite population, infinite population). Stratified sampling. Parameter estimation. Method of moments. Standard error. Unbiasedness. Maximum likelihood method. Asymptotic distribution of maximum likelihood estimators. Confidence intervals. Testing statistical hypotheses. Statistical hypothesis. Statistical test. Statistical error. Classical statistical hypothesis testing. The Neyman-Pearson paradigm . Significance level. The concept of p-value. One sample statistical tests, two-sample tests. c2-goodness of fit test, the Kolmogorov-Smirnov test,. c2-of homogeneity, c2-for independence, hypothesis testing for paired dana. The Analysis of Variance. One-way ANOVA. Correlation and regression. Correlational analysis. Regression analysis. Parameter estimation. Gauss - Markov theorem. ANOVA-table. Prediction.		
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐
Student obligations	Pohađanje nastave, izrada domaćih zadataka.		

Monitoring student work	Class attendance	0.1	Research		Practical work	1
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam	0.4		
	Written exam	3.5	Project			
Assessment and evaluation of student work	Attending lectures, writing homework, written and oral exam. During the semester, students have the possibility to partially take written exams through colloquia (twice during the semester). Students who pass both colloquia don't need to take part in the written exam.					

Required literature	Title	Number of copies available	Availability on other medium
	N. Sarapa, Teorija vjerojatnosti, Školska knjiga, Zagreb, 2002.		
	John A. Rice, Mathematatical Statistics and Data Analysis, Second Edition, Duxbury Press, 1996.		da
	F. Daly, D. J. Hand, M. C. Jones, A. D. Lunn, K. J. McConway, Elements of Statistics, Addison Wesley, 1995		

Supplementary literature	G. K. Bhattacharyya, R. A. Johnson, Statistical Concepts and Methods, John Wiley & Sons, 1977. Ž. Pauše, Uvod u matematičku statistiku, Školska knjiga, Zagreb, 1993. R.V. Hogg, A.Craig, J.W. McKean, Introduction to Mathematical Statistics, 6th edition, Pearson Prentice Hall D. Freedman, R. Pisani, R. Purves, A. Adhikari, Statistics, 2nd edition, W. W. Norton & Co, 1991. D. J. Savile, G. R. Wood, Statistical Methods. A Geometric Primer, Springer Verlag, 1996. D. Williams, Weighing the Odds, Cambridge University Press, 2001. Priručnici za korištenje R-a (npr. W.N. Venables i D.M. Smith (M.Kumbatović, Kasum D.), Uvod u korištenje R-a)
Quality assurance	Summarizing test results and conducting an anonymous student survey at the end of the course. The survey is conducted according to the rules of the University of Split. .
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Stochastic Simulations in Classical and Quantum Physics</td></tr>
<tr><td>ID</td><td>PMP271</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Leandra Vranješ Markić</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Deeper understanding of selected topics of classical and quantum physics.
Understanding the advantages and limitations of Monte Carlo simulations.
Testing and developing simpler simulations.
The ability to visualise and critically evaluate obtained results.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Basic knowledge of statistical and quantum physics, as well as programming.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Know several Monte Carlo simulation methods.
2. Be able to independently develop and apply Metropolis algorithm for a given probability distribution.
3. Be able to evaluate the efficiency and validity of the results of a given Monte Carlo algorithm.
4. Understand the advantages and limitations of stochastic simulations of phase transitions.
5. Be able to apply the learned methods to selected problems of classical and quantum many-body physics and to interpret the obtained results.
6. Adapt the program to run on high performance computing (HPC) clusters.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Basic techniques of stochastic simulations are introduced and applied to different physical systems and models.
The exercises on computers follow the following content of the lectures according to the same schedule.
DETERMINISTIC RANDOMNESS
(1h) Pseudorandom number generators.
(1h) Testing for randomness and uniformity.
(2h) Simulating random variables. Random walk.
(4h) Brownian dynamics. Diffusion and entropy.
(2h) Distributions. Percolation.
(2h) Radioactive decay.
(1h) Distribution transformation methods and rejection methods.
(1h) Multidimensional integration using Monte Carlo methods.
(2h) Markov chains. Metropolis algorithm.
(2h) Estimation of statistical errors.
MONTE CARLO SIMULATIONS OF THERMAL SYSTEMS
(2h) Ideal gas. Demon algorithm.
(2h) Ising model. Periodic boundary conditions.
(2h) Simulation on High Performance Computing (HPC) clusters.
(3h) Simulation of continuous systems. Classical fluids.
QUANTUM MONTE CARLO METHODS
(3h) Variational Monte Carlo. Diffusion Monte Carlo.</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☑ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Homework during semester.
Final project and presentation.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 2; Research: ; Practical work: 2
Experimental work: ; Paper:
Essay: ; Seminar paper:
Colloquiums: ; Oral exam:
Written exam: ; Project: 2</td></tr>
<tr><td>Assessment and evaluation</td><td colspan="3">Homework and the final project, in which the student should independently develop</td></tr>
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<table>
<tr><td>of student work</td><td colspan="3">the program using the appropriate Monte Carlo method, and presentation are evaluated.
For homework and project, the students should write a report in which they answer the questions asked and critically evaluate obtained results.</td></tr>
<tr><td rowspan="3">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>[1] L. Vranješ Markić, P. Stipanović: "Stohastičke simulacije u klasičnoj i kvantnoj fizici", skripta, PMFST, Split, 2016.</td><td></td><td>yes</td></tr>
<tr><td>[2] Harvey Gould, Jan Tobochnik, and Wolfgang Christian: "An Introduction to Computer Simulation Methods", 3rd revised edition, 2016. URL: https://www.compadre.org</td><td></td><td>yes</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">[3] R. H. Landau & M. J. Paez: "Computational Problems for Physics", CRC Press, Taylor & Francis, 2018.
[4] M. P. Allen & D. Tildesley: "Computer Simulation of Liquids", Clarendon Press, Oxford, 1987.
[5] Different web pages.</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Lecturers who teach subjects, which have correlated learning outcomes, collaborate and take care of teaching quality.
Discussion with students and analyzing their progress in solving problem and project tasks.
Statistics of exam results and evaluation of efficacy in accordance with the learning outcomes.
Student evaluation by anonymous survey conducted according to the rules of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
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<table>
<tr><td>Subject name</td><td colspan="3">Machine Learning</td></tr>
<tr><td>ID</td><td>PMIH21</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Saša Mladenović</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30 | S: 0 | E: 30 | P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>25%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The course goal is introducing students to the artificial intelligence field dealing with algorithm design based on collected data. Students will have the opportunity to learn about machine learning basics and its applications in classification, data mining, bioinformatics, natural language processing, robotics, autonomous vehicles. During the course, students will learn and apply supervised and unsupervised learning methods in a domain of interest.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Passed exam - Introduction to artificial intelligence
Good knowledge of the object-oriented programming paradigm
Good knowledge of the implementation of the statistics</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Define basic concepts of machine learning
Argument benefits and weaknesses of basic machine learning algorithms for a specific domain
Evaluate the fitness of different models
Design use and evaluate data classification and grouping algorithms
Demonstrate the possibility of using machine learning by creating an application for a specific domain of interest</td></tr>
<tr><td>Syllabus</td><td colspan="3">Introduction to machine learning and motivation for its usage
Different approaches to machine learning and different application environments
The dimensionality of the problem, bias, generalisation and training problem
Probabilistic models, Bayes classifier
Linear and logistic regression models, benefits and pitfalls
Linearly separable problems, perceptron and generalisation of separability based on multilayer perceptron
Support vector machines, kernel functions and regression
Nonparametric methods. k-nearest neighbours algorithm. Decision trees.
Feature selection, data visualisation and training results
Clustering, k-means algorithm, hierarchical clustering
Actual usage of machine learning
How to get the data? Data collection methods
Ethical questions in machine learning usage</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☑ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3"></td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td>0.5</td><td>Practical work</td><td>1</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>0.5</td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td>1</td><td></td><td></td></tr>
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</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3"></td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Kanber, Burak. Hands-on Machine Learning with JavaScript: Solve complex computational web problems</td><td></td><td></td></tr>
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	using machine learning. Packt Publishing Ltd, 2018.		
	Ng, A. "Machine learning yearning: Technical strategy for ai engineers in the era of deep learning." (2019).		
	Ethem Alpaydin; Introduction to Machine Learning, Fourth Edition; MIT press, 2020.		
Supplementary literature	In accordance to the chosen domain.		
Quality assurance	Student discussion, anonymous student evaluation questionnaire, student success rate, self-assessment		
Other (in the opinion of the proponent)			

Subject name	Light and Photosynthesis in the Sea						
ID	PMP26G	Study year	1.				
Lecturer	doc. dr. sc. Žarko Kovač	Points value (ECTS)	4.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	20	0	0	
Subject status	Elective	Online percentage	0%				

Subject description

Subject goals	– acquiring basic knowledge about marine optics and bio-optical models of photosynthesis – to provide knowledge about the use of partial differential equations and the theory of dynamic systems when describing bio-optical processes in the sea – acquire knowledge about primary production models from local to global scale – get acquainted with the basics of the critical depth theory, critical light theroy and the critical turbulence theory – provide basic knowledge about the coupling of physical processes and photosynthesis in the sea
Enrolment requirements	– Mathematical methods of physics II – Differential equations – Programming
Learning outcomes	1. Understand inherent and apparent optical properties. 2. Know the basics of radiative transfer theory. 3. Know how to calculate the intensity of the underwater light field based on knowledge of solar radiation. 4. Understand the relationship between the carbon assimilation rate in photosynthesis and light intensity. 5. Understand the vertical structure of primary production and chlorophyll in the sea. 6. Know the basics of the critical depth theory, critical light theory and critical turbulence theory. 7. Basic knowledge on spectral effects in photosynthesis. 8. Master the mathematical apparatus used in modern oceanography to describe the connection between physical and biological processes.
Syllabus	1. Inherent and apparent optical properties of ocean water (2 hours of lectures) 2. Radiative transfer theory (2 hours of lectures) 3. Solar radiation (2 hours of lectures) 4. Underwater light field (2 hours of lectures) 5. Light saturation function (2 hours of lectures) 6. Primary production profile (4 hours of lectures) 7. Watercolumn produciton (4 hours of lectures) 8. Vertical dynamics of chlorophyll in the ocean (4 hours of lectures) 9. Critical depth theory (2 hours of lectures) 10. Critical light theory (2 hours of lectures) 11. Critical turbulence theory (2 hours of lectures) 12. Spectral effects (2 hours of lectures)
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring ☐ ☐ ☐ ☐
Student obligations	Attend at least 70% of lectures and 70% of exercises.

Monitoring student work						
	Class attendance	1	Research		Practical work	1
	Experimental work		Paper		Domaće zadaće	1
	Essay		Seminar paper			
	Colloquiums		Oral exam	1		
	Written exam		Project			

Assessment and evaluation of student work	During the first 7 weeks of classes, students receive 5 homework assignments from the first 5 teaching units. These assignments are handed in at the end of the 8th week of classes. During the next 7 weeks of classes, students receive 5 new homework assignments from the following 5 teaching units. These assignments are handed in at the end of the 15th week of classes. Students who submit assignments

<table>
<tr><td></td><td>on time and achieve more than 50% of possible points are exempt from writing the written part of the exam. Students who do not hand in assignments or obtain less than 50% of the possible points must take a written exam. In the first 7 weeks of classes, the teacher holds seminars and solves more complex problems analytically and numerically together with the students. In the 8th week of classes, students choose a model that they analyze analytically, and implement a numerical version of the model and conduct simulations. Students present the obtained simulations at the end of the semester. The final grade is formed on the basis of homework/exams (1/3 of the grade), simulations (1/3 of the grade) and answers to the oral exam (1/3 of the grade).</td></tr>
<tr><td>Required literature</td><td><table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>John T. O. Kirk Light and photosynthesis in aquatic ecosystems Cambridge Universiy Press, 2011.</td><td>2</td><td>yes</td></tr>
<tr><td>Curtis D. Mobley The oceanic optics book Creative Commons Licence</td><td>0</td><td>yes</td></tr>
<tr><td>Mark Kot Elements of Mathematical Ecology Cambridge Universiy Press, 2001.</td><td>2</td><td>yes</td></tr>
</table></td></tr>
<tr><td>Supplementary literature</td><td>Internal script and scientific papers.</td></tr>
<tr><td>Quality assurance</td><td>Discussion with students and analysis of their progress in solving problems and tasks. Statistics of exam results and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the rules of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Text and Graphical Programs for Physicists</td></tr>
<tr><td>ID</td><td>PMP071</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Martina Požar</td><td>Points value (ECTS)</td><td>1.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td><table><tr><td>L</td><td>S</td><td>E</td><td>P</td></tr><tr><td>0</td><td>0</td><td>30</td><td>0</td></tr></table></td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Ability to use Gnuplot.
Ability to use LaTeX.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After successfully mastering the course, students will be able to
use the programs as follows:
1) Gnuplot
– draw 2D and 3D graphs,
– fit functions on numerical data,
– write scripts that generate drawings;
2) LaTeX
– make presentations,
– write a seminar and laboratory report,
– edit the content (text, images, formulas, tables...) for
publication in the form of a scientific article, book...</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Gnuplot (10h)
(3h) Drawing 2D graphs.
(2h) Fitting functions to numerical data.
(2h) Schematic representations using geometric figures.
(3h) Drawing 3D graphs.
2. LaTeX (20h)
(3h) Introduction to LaTeX2e. Text input and formatting.
(5h) Writing mathematical formulas (equations).
(2h) LaTeX environments. List. Tables.
(2h) Insert images and draw with TikZ.
(2h) Structuring a document (article, book…).
(2h) Definition of own commands and environments.
(2h) Defining mathematical environments such as theorems.
(2h) Making presentations using the beamer package.</td></tr>
<tr><td>Teaching types</td><td colspan="3"><table><tr><td>☐ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr></table></td></tr>
<tr><td>Student obligations</td><td colspan="3">Attendance and commitment of students in class, making assignments with help and independently in class or at home.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td>0.7</td><td>Research</td><td></td><td>Practical work</td><td>0.3</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">During the semester, the student's work on the computer is monitored and scored (20% of the final mark) and exams for
LaTeX (50%) and Gnuplot (30%) are written.
The final grade is formed according to the following list:
[50.60>% = sufficient (2)
[60.75>% = good (3)
(75.90>% = very good (4)
[90,100]% = excellent (5)</td></tr>
<tr><td>Required literature</td><td colspan="3"><table><tr><td>Title</td><td>Number of copies</td><td>Availability on other medium</td></tr></table></td></tr>
</table>

		available	
	[1] Š. Ungar, Not so short introduction to TeX with emphasis on LaTeX2ε, University of Osijek, Department of Mathematics, Osijek 2002. (web)		
	[2] Instructions that come with the Gnuplot software package.		
Supplementary literature	[1] Thomas Williams, Colin Kelley: An Interactive Plotting Program gnuplot 5.0, URL: http://www.gnuplot.info/docs_5.0/gnuplot.pdf, siječanj 2016. [2] ShareLaTeX Documentation, URL: https://www.sharelatex.com/learn.		
Quality assurance	1. Teachers, who teach other similar subjects, cooperate and jointly take care of the quality of teaching. 2. Students can send anonymous comments related to the teaching method via the web application. 3. Test result statistics. 4. Student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="6">Fundamental Concepts in Physics</td></tr>
<tr><td>ID</td><td>PMP106</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Bernarda Lovrinčević</td><td>Points value (ECTS)</td><td colspan="4">3.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>15</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">50%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Understanding the conceptual foundations of mechanics, fluid mechanics, waves and thermodynamics. Acquiring operational knowledge in solving numerical problems. Achieving the skill of reducing a physical problem into an appropriate mathematical model using equations.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Enrolled in Undergraduate Studies.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. demonstrate knowledge of motion kinematics in one, two and three dimensions;
2. state and explain Newton's laws of motion and apply them in numerical examples;
3. explain the concepts of work, kinetic and potential energy, momentum of force and momentum and apply the laws of conservation of energy and conservation of momentum in specific examples;
4. demonstrate knowledge of the kinematics and dynamics of rigid body rotation and solve problems involving rigid body rotation;
5. explain the concept of hydrostatic pressure and buoyancy and apply the continuity equation and the Bernoulli equation in numerical examples;
6. explain a simple harmonic oscillator and describe the formation and propagation of waves, the occurrence of wave interference, wave resonance and the Doppler effect;
7. state and explain the basic laws of thermodynamics, define the concept of heat and describe the mechanisms of heat transfer.</td></tr>
<tr><td>Syllabus</td><td colspan="6">1. Motion along a straight line.
2. Motion in two and three dimensions.
3. Force and Newton's laws.
4. Application of Newton's laws.
5. Work and kinetic energy.
6. Potential energy and the law of energy conservation.
7. Momentum and collisions.
8. Rigid body rotation.
9. Equilibrium conditions and their application.
0. Fluid mechanics.
11. Oscillations.
12. Waves.
13. Solids and fluids.
14. Heat and heat transitions.
15. Fundamentals of thermodynamics.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="3">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Attending lectures and seminars, at least 70% of lectures and 80% of seminars. Write a seminar paper on the selected topic and present it in the form of a presentation to colleagues and the teacher. Solve at least 50% of the written exam.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Seminari</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">1. Seminar paper (written part) – 25% of the grade
2. Seminar paper (presentation) – 25% of the grade
3. Written exam – 50% of the grade</td></tr>
</table>

Required literature	Title	Number of copies available	Availability on other medium
	D. Halliday, R. Resnick, J. Walker, Fundamentals of Physics. 9th Edition, John Wiley, New York 2011.		
Supplementary literature	1. P. G. Hewitt, Conceptual Physics, 12th Edition, Pearson 2010. 2. H. D. Young, R. A. Freedman, Sears and Zemansky's University Physics, 12th Edition, Pearson, 2008.		
Quality assurance	Exam results statistics and student evaluation through a survey conducted by the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="4">Design Theory</td></tr>
<tr><td>ID</td><td>PMM614</td><td>Study year</td><td colspan="2">1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Aljoša Šubašić</td><td>Points value (ECTS)</td><td colspan="2">5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td colspan="2">L: 45, S: 0, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="2">10%</td></tr>
<tr><td colspan="5">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="4">To introduce students to the basic definitions, terms, procedures, and theorems of design theory
To make a connection between different combinatorial structures, and to connect designs with graphs, difference sets, Latin squares
To introduce basic applications of combinatorial designs in different areas such as board game design and similar.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="4">Basic knowledge of linear algebra.</td></tr>
<tr><td>Learning outcomes</td><td colspan="4">After taking and passing this course students are able to
Differenciate all notions and properties of designs, and can apply that knowledge towards solving problems;
Analyse different combinatorial structures and describe their properties, and also explain connections between those structures;
Mathematicly prove the basis for their procedures and formulas they use that are within this course;
Make a model of their own board game constructed by a certain design</td></tr>
<tr><td>Syllabus</td><td colspan="4">Basic notions of design theory. 6 hours
Isomorphisms and automorphisms, constructions of new designs, Fisher's inequality. 3 hours
Symmetric designs, derived and residual designs, Bruck-Ryser-Chowla. 3 hours
Difference sets. 3 hours
Hadamards matrices and designs. 3 hours
Latin squares. 3 hours
Steiner triple systems. 3 hours
Flag-transitive designs, primitive i imprimitive designs. 6 hours
Subdesigns and quotient designs. 3 hours
t-designs. 3 hours
Design applications. 3 hours</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="4">Class attendance and one seminar paper.</td></tr>
<tr><td>Monitoring student work</td><td colspan="4">Class attendance: 1; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper: 2
Colloquiums: ; Oral exam: 2
Written exam: ; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="4">Seminar paper and the final oral exam.</td></tr>
<tr><td>Required literature</td><td colspan="4">

Title	Number of copies available	Availability on other medium
Douglas R. Stinson: Combinatorial designs. Constructions and analysis		

</td></tr>
<tr><td>Supplementary literature</td><td colspan="4">Beth, Jungnickel, Lenz: Design Theory, Volume 1</td></tr>
<tr><td>Quality assurance</td><td colspan="4">Statistics of test results and student evaluation via anonymous questionnaires at the</td></tr>
</table>

	end of the course. The survey is conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Graph theory</td></tr>
<tr><td>ID</td><td>PMM806</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Tanja Vojković</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The aim of the course is to introduce students to the basic topics and methods of graph theory.
Students will learn to understand properties of graphs, and their importance in applications..</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Entry competences: Students should be familiar with basic concepts of linear algebra.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Students will be able to :
correctly formulate theorems and definitions of important concepts,
illustrate the concepts and conclusions with adequate examples,
construct mathematical proofs,
model and solve problems using graph theory,
apply the obtained knowledge and skills to investigate and solve a variety of graph theory problems,
clearly and unambiguously communicate their arguments and conclusions to both laics and experts
have the learning skills which enable lifelong education in this field</td></tr>
<tr><td>Syllabus</td><td colspan="3">Introduction. Graphs and drawings of graphs. Basic concepts of graph theory. Examples of different graph types. (3)
Bipartite graphs. Graph isomorphisms. (2)
Connectivity in graphs, walks and paths. (3)
Euler and Hamiltonian graphs. (3)
Trees, characterization and properties, counting trees. (3)
Graph colorings, vertex and edge colorings, chromatic number (4)
Planar graphs, Euler’s theorem, colorings of planar graphs. (3)
Directed and weighted graphs. (3)
Vertex and edge connectivity. (2)
Pairings in graphs, vertex and edge covers, perfect and maximal matchings. (4)</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td></tr>
<tr><td>Student obligations</td><td colspan="3">Class attendance. Students are expected to be present at least 70% of classes.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 3; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper:
Colloquiums: ; Oral exam: 1
Written exam: 1; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Two partial written exams / one final written exam and final oral exam.
There are 2 partial written exams during the semester. Passing the both partial exams or the final written exam allows students to take the oral exam. Successfully passing the oral exam leads to a successful completion of the course.</td></tr>
<tr><td>Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td></td><td>A. Golemac, Osnove teorije grafova, skripta, PMF, Split, 2014.</td><td></td><td></td></tr>
<tr><td></td><td>D. Veljan, Kombinatorna i diskretna matematika, Algoritam, Zagreb, 2001</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

	D. Veljan, Kombinatorika s teorijom grafova, Školska knjiga, Zagreb, 1989.		
Supplementary literature	J. Matoušek, J. Nešetril, Invitation to Discrete Mathematics, Oxford University Press, Oxford, 1998. R.J. Wilson, Introduction to Graph Theory, Longman, Harlow, Essex, 1999.		
Quality assurance	Anonymous student evaluations according to the regulations of the University of Split and summarizing test results.		
Other (in the opinion of the proponent)			

Subject name	Teorija igara		
ID	PMM127	Study year	2.
Lecturer	prof. dr. sc. Damir Vukičević	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Elective	Online percentage	15%

Subject description

Subject goals	Student se upoznaje s osnovama teorije igara. Zna objasniti osnovne koncepte teorije igara, riješiti jednostavnije probleme iz teorije igara, te prepoznati probleme (iz stvarnog života) koji se mogu riješiti teorijom igara. Može uočiti jednostavnije veze između ekonomskih pojavnosti i teorije igara.
Enrolment requirements	Uvjet za upis: odslušani i položeni uvodni matematički kolegiji Potrebne kompetencije: poznavanje elementarnih matematičkih funkcija, bazično znanje integrala i derivacija.
Learning outcomes	Student je sposoban: – definirati osnovne pojmove vezane uz: dominacije strategija, Nashovih ekvilibrija, evolucijske i ekonomske modele; – analizirati različite vrste Nashovih ekvilibrija; – analizirati moguće ishode jednostavnijih igara; – riješiti jednostavnije igre; – usporediti različite tipove aukcija; – analizirati aksiome funkcije korisnosti i Nashove aksiome; – primijeniti teoriju igara na jednostavnije ekonomske modele.
Syllabus	dominantne i dominirane strategije (2) čisti Nashov ekvilibriji, igre sume nula i mješoviti Nashovi ekvilibriji (4) ekonomski modeli (4) evolucijski modeli (2) primjeri odabranih igara (2) konačne igre i indukcija unatrag (2) igre potpune informacije i igre nepotpune informacije (2) repetativne igre i moralni rizik (2) primjeri odabranih igara (2) aukcije (2) funkcija korisnosti (2) problem pregovaranja (4)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Pohađanje nastave, uspješno pisanje kolokvija.

Monitoring student work

Class attendance	1.5	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	1.5	Oral exam	2		
Written exam		Project			

Assessment and evaluation of student work	Kolokviji, završni usmeni i pismeni ispit.

Required literature

Title	Number of copies available	Availability on other medium
Open Yale Course on Game Theory. http://oyc.yale.edu/economics/econ-159		
M. J. Osborne, A. Rubinstein: A Course in Game Theory, MIT Press, 1998		

Supplementary literature	J.H.Conway, On Numbers and Games, Academic Press, 1976 E. Berlekamp, H. Conway, R.Guy,Winning ways for your mathematical plays, AK Peters Ltd, 2001 (Vol 1) E. Berlekamp, H. Conway, R.Guy,Winning ways for your mathematical plays, AK Peters Ltd, 2001 (Vol 2) E. Berlekamp, H. Conway, R.Guy, Winning ways for your mathematical plays, AK Peters Ltd, 2001 (Vol 3) E. Berlekamp, H. Conway, R.Guy,Winning ways for your mathematical plays, AK Peters Ltd, 2001 (Vol 4)
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Game Theory</td></tr>
<tr><td>ID</td><td>PMM127</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Damir Vukičević</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 45, S: 0, E: 15, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>15%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Student learns the basics of game theory. He is capable to explain basic concepts of game theory, solve simpler problems in game theory and recognize real-life situations on which game theory can be applied. He can note and comprehend interplay between game theory and economics.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Prerequisites: introductory mathematical course completed.
Required competencies: knowledge of elementary mathematics basic knowledge of integrals and derivatives.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Student is able to:
– define basic notions related to dominant strategies, Nash's equilibria, evolutionary and economical models;
– analyze different types of Nash's equilibria;
– analyze outcomes of simpler games
– solve simpler games;
– compare different auction types;
– analyze axioms of utility function and Nash axioms;
– apply game theory on simpler economic models.</td></tr>
<tr><td>Syllabus</td><td colspan="3">dominant and dominated strategies (2)
pure Nash equilibrium, zero-sum games, mixed Nash equilibrium (4)
economical models (2)
evolutionary models (2)
exemplary games (2)
finite games and backward induction(2)
games of complete and non-complete information (2)
repetitive games and moral risk (2)
exemplary games (2)
auctions (2)
utility function (2)
negotiation problem (4))</td></tr>
<tr><td>Teaching types</td><td colspan="3">☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online
☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring
☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Lectures attendance and passing colloquium exams.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>1.5</td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Colloquiums, final (written and oral) exam.</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Open Yale Course on Game Theory. http://oyc.yale.edu/economics/econ-159</td><td></td><td></td></tr>
<tr><td>M. J. Osborne, A. Rubinstein: A Course in Game Theory, MIT Press, 1998</td><td></td><td></td></tr>
</table></td></tr>
</table>

Supplementary literature	J.H.Conway, On Numbers and Games, Academic Press, 1976 E. Berlekamp, H. Conway, R.Guy,Winning ways for your mathematical plays, AK Peters Ltd, 2001 (Vol 1) E. Berlekamp, H. Conway, R.Guy,Winning ways for your mathematical plays, AK Peters Ltd, 2001 (Vol 2) E. Berlekamp, H. Conway, R.Guy, Winning ways for your mathematical plays, AK Peters Ltd, 2001 (Vol 3) E. Berlekamp, H. Conway, R.Guy,Winning ways for your mathematical plays, AK Peters Ltd, 2001 (Vol 4)
Quality assurance	Statistics of exam results and student's course evaluation (survey according to rules of the University of Split).
Other (in the opinion of the proponent)	

Subject name	Relativity						
ID	PMP401	Study year	1.				
Lecturer	doc. dr. sc. Toni Šćulac	Points value (ECTS)	4.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	30	0	
Subject status	Elective	Online percentage	10%				

Subject description

Subject goals	Understanding and explaining basic concepts from the special and general theory of relativity.
Enrolment requirements	Classical mechanics II (passed) Electrodynamics II (passed)
Learning outcomes	1. Explain Minkowski diagrams 2. Calculate kinematics of particle interactions using four-vectors and tensors 3. Understand postulates of special relativity and explain their consequences (simultanity, time dilatation, length contraction, clock synchronisation) 4. Explain principle of equivalence 5. Describe basics of black holes and gravitational waves 6. Describe gravity as curvature of spacetime 7. Explain gravitational redshift
Syllabus	1. Postulates of special relativity (2+2) 3. Einsten-Lorentz transformations (2+2) 4. Four-velocity and four-momentum (2+2) 5. Kinematics of particle interactions (2+2) 6. Reletivistic field theory (2+2) 7. Relativistic Lorentz law (2+2) 8. Relativistic formulation of Maxwell's equations (2+2) 9. Maxwell's equations from the action principle (2+2) 10. Energy-momentum tensor (2+2) 11. Differential geometry (2+2) 12.Field equations in general relativity (2+2) 13. Schwarzchild's solution (2+2) 14. Basics of black holes (2+2) 15. Gravitational waves (2+2)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Attend at least 70% of lectures and 70% of exercises.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam	1		
Written exam	1	Project			

Assessment and evaluation of student work	Two interim exams and a final exam.

Required literature

Title	Number of copies available	Availability on other medium
L. Susskind, A. Friedman, Special Relativity and Classical Field Theory, Penguin books, 2018.	0	yes
Ray D'Inverno, Introducing Einstein's Relativity, 1992	0	yes

Supplementary literature	V. A. Ugarov. Special Theory of Relativity, MIR 1979. 1. W. Rindler: Relativity , Oxford, 2006
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the

	end of the course. The survey is conducted according to the regulations of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Set theory</td></tr>
<tr><td>ID</td><td>PMM112</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Goran Erceg</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Students will:
-gain insight in Set theory necessary for understanding and learning other mathematical concepts
-learn to conduct various set operations and operations with cardinals and ordinals
-learn to compute cardinality of sets given in various ways
- gain a deeper insight in a historical significance of Cantor's "naive" approach to Set theory
-learn the Zermelo-Frankel system of axioms and understand its role in avoiding paradoxes.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon successful completion of this course students will be able to:
- explain and evaluate a historical role of Cantor's naive approach to Set theory
- axiomatically describe Set theory by the Zermelo-Frankel system of axioms
-compute cardinality of sets given in various ways
-apply cardinal and ordinal numbers arithmetic and order between cardinals and ordinals
-apply the Cantor-Bernstein theorem and other theorems on cardinality
-characterize order types of the sets N, Z, Q and R
-define the ordinal number and number class
-apply Transfinite induction
-state various theorems equivalent to Axiom of choice.</td></tr>
<tr><td>Syllabus</td><td colspan="3">- Introduction. Cantor's "naive" approach to Set theory. Paradoxes. (1)
- The Zermelo-Frankel system of axioms .(4)
-Relations and functions. (1)
-Inductive and transitive sets. Peano axioms. The Recursion theorem. (3)
-The Axiom of choice. The function of choice. A family of sets. The product of set family. (1)
-Finite and infinite sets. (2)
-Equipotent sets. Cardinal numbers. The Cantor-Bernstein theorem. (2)
-Countable sets. The product and union of countable sets. (4)
-Uncountable sets. Continuum. The continuum hypothesis. (2)
-A partial order. A total order. Isomorphisms of ordered sets. Order types. (4)
-Characterizations of the ordered sets N, Z, Q and R. (2)
-Well-ordered sets. Ordinal numbers. Transfinite induction. The Buralli-Forti paradox. (2)
-Number classes. Statement equivalent to the Axiom of choice. (2)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending classes. Students are expected to be present at least 70% of classes.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 2; Research: ; Practical work:
Experimental work: ; Paper:
Essay: ; Seminar paper:
Colloquiums: ; Oral exam: 2
Written exam: 2; Project: </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Two partial written exams / one final written exam and final oral exam.
There are 2 partial written exams during a semester. Passing both partial exams enables students to take an oral exam. Successfully passing the oral exam leads to successful completion of the course. Final grade is derived as the arithmetic mean of scores in partial exams (or a written exam) and the oral exam. In the case of failure</td></tr>
</table>

	in partial exams or the oral exam students must undergo a written exam before taking oral exam again. Written exam consists of practical and theoretical exercises.		
Required literature	Title	Number of copies available	Availability on other medium
	V. Matijević, Uvod u teoriju skupova, nastavni materijal-skripta		
	P. Papić, Uvod u teoriju skupova, HMD, Zagreb,2000.		
	H.B. Enderton, Elements of Set Theory, Academic Press, New York, 1977P		
Supplementary literature	K. Kuratowski, A. Mostowski, Set Theory, PWN, Warszawa, 1968.		
Quality assurance	Summarizing test results and conducting an anonymous student survey at the end of the course. The survey is conducted according to the rules of the University of Split. u.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Field Training in Vertebrates</td></tr>
<tr><td>ID</td><td>PMB033</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Mate Šantić</td><td>Points value (ECTS)</td><td>0.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15, S: 0, E: 0, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3"></td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Zoology</td></tr>
<tr><td>Learning outcomes</td><td colspan="3"></td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☑ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring
☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3"></td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical work</td><td>0.5</td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3"></td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Jardas I, Pallaoro A, Vrgoč N, Jukić Peladić S, Dadić V. 2008. Crvena knjiga morskih riba Hrvatske. Ministarstvo kulture, Državni zavod za zaštitu prirode RH 396 pp.</td><td></td><td></td></tr>
<tr><td>Janev Hutinec B, Kletečki E, Lazar B, Podnar Lešić M Skejić J, Tadić Z, Tvrtković N. 2006. Crvena knjiga vodozemaca i gmazova Hrvatske, Ministarstvo kulture, Državni zavod za zaštitu prirode RH 95 pp.</td><td></td><td></td></tr>
<tr><td>Antolović J, Frković A, Grubešić M, Holcer D, Vuković M Flajšman E, Grgurev M, Hamidović D, Pavlinić I, Tvrtković N. 2006. Crvena knjiga sisavaca Hrvatske, Ministarstvo kulture, Državni zavod za zaštitu prirode RH 127 pp.</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Supplementary literature</td><td colspan="3"></td></tr>
<tr><td>Quality assurance</td><td colspan="3">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="6">Thermodynamics</td></tr>
<tr><td>ID</td><td>PMP007</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Ante Bilušić</td><td>Points value (ECTS)</td><td colspan="4">9.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>60</td><td>15</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">20%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Understanding the concepts and laws of thermodynamics and their application.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Acquired content from mathematical analysis, mechanics, and electricity and magnetism.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">1. Explain the basic concepts of thermodynamics and analyze the effects of temperature changes on bodies.
2. Analyze and apply methods of heat transfer and calculate the amount of heat transferred using specific examples.
3. Introduce and explain specific heat of transformation. Analyze phase transitions, describe the phase diagram, critical points and triple points, and derive the Clausius-Clapeyron equation.
4. Determine the relationship between temperature and the mean kinetic energy of molecules in the kinetic-molecular theory of heat, and derive and apply expressions for the mean free path and pressure of an ideal gas.
5. Explain the term "ultraviolet catastrophe" and analyze Planck's law of blackbody radiation and the other laws of radiation derived from it.
6. Describe the basic concepts of thermodynamics (thermodynamic system, environment, closed system, isolated system, extensive and intensive thermodynamic parameters, equilibrium, reversible and irreversible processes).
7. Derive the equation of state of an ideal gas and analyze the equation for real gasses (Van der Waals equation).
8. Formulate and apply the laws of thermodynamics (calculate the work done by different changes of state of the gas, analyze the work done by heat engines and refrigerators, determine the entropy change for different systems).
9. Compare heat capacities and derive the relationship between them. Estimate the relationship between heat capacities at constant volume and pressure. Describe and apply the mixing method to determine the unknown heat capacity.
10. Explain the thermodynamic potentials and use them to calculate the volume, temperature, pressure, and entropy of the gas.
11. Analyze two bodies in thermal contact and describe the conditions under which a steady state of the system occurs and a system with a variable number of particles and describe the meaning of chemical potential.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Lectures with demonstration experiments:
• (4 hours) Dynamical, thermodynamical and statistical description of many-particle systems
o Model of ideal gas
o Sketch diagrams of isothermal, isobaric, and isovolumic processes in the p,V diagram
• (4 hours) Internal energy
o Work
o Heat
o The first law of thermodynamics
• (5 hours) Heat capacity
o The importance of heat capacities in relation to experimental verification of theory
o Mayer's relationship
o The importance of the dependence of heat capacity on temperature for the development of quantum physics
• (13 hours) Second Law of Thermodynamics
o Kelvin's and Clausius's formulation of the second law of thermodynamics
o Clausius relation
o Definition of the second law of thermodynamics through the increase of entropy in closed system
o The greatest utility and the greatest power of the circular process
o Boltzmann's definition of entropy
o Reversibility of dynamic processes and irreversibility of processes in nature
o Gibbs definition of entropy</td></tr>
</table>

o Shann's definition of information entropy. Difference between information entropy and thermodynamic entropy
o Jayne's principle of maximum information entropy
o Derivation of Gibbs distribution by Jayne's principle of maximum information entropy
• (6 hours) The third law of thermodynamics
o The impossibility of reaching the absolute zero temperature
o Enthalpy and Gibbs free energy. Maxwell's relations.
o Van der Waals equation of state of a real gas. Maxwell's construction.
o Law of appropriate states.
• (5 hours) Phase transitions
o Definition of phase transitions.
o Phase diagram, coexistence curves, Clausis-Clapeyron equation, boiling, dependence of saturated vapor pressure on temperature.
• (2 hours) Solutions
o Osmosis and vant Hoff's equation.
o Rault's and Henri's law.
• (8 hours) Exchanging-particles systems
o Chemical potential and equilibrium state of systems exchanging particles.
o Construction of phase diagram using chemical potential.
o Gibbs distribution for exchanging-particles systems
o Application to quantum systems with identical particles. Fermi-Dirac and
o Bose-Einstein distribution.
• (4 hours) Chemical reactions
o Exothermic and endothermic reactions.
o Law of mass action.
o pH factor
• (4 hours) Surface effects
o Surface pressure.
o Metastable states and change in phase transition temperature on curved surfaces
• (5 hours) Transfer phenomena
o Mean free path
o Diffusion coefficients, thermal conductivity and viscosity of an ideal gas
o Poisseuille's formula

Exercises:
1. (2 hours) Statistics - introduction
2. (2 hours) Kinetic theory of ideal gases
3. (2 hours) Maxwellian distribution
4. (3 hours) Work and heat. The first law of thermodynamics, part I
5. (3 hours) Work and heat. The first law of thermodynamics, part II
6. (3 hours) Entropy, Part I
7. (3 hours) Entropy, part II
8. (3 hours) Van der Waals equation of state
9. (3 hours) Phase transitions
10. (2 hours) Joule-Thomson effect
11. (2 hours) Capillary pressure
12. (2 hours) Diffusion, conductivity and viscosity

Seminar topics:
• Thermal relaxation of gases during diffusion
• Classical mechanics, quantum mechanics and temperatures
• Measurement of macroscopic quantities
• Ideal gas in an external field and Boltzmann distribution
• Heat capacity of an ideal gas and heat capacity of a solid
• Adiabatic and polytropic processes
• The second law of thermodynamics and the equivalence of the two formulations
• Stirling engine
• Working principle of an internal combustion engine
• Functioning of the refrigerator
• Statistical interpretation of entropy
• Information entropy and the Shannon theorem
• Sackur-Tetrode equation
• Thermodynamic potentials
• Stability of thermodynamic systems
• Van der Waals equation

<table>
<tr><td></td><td colspan="3">• Phase transitions and the Clausius-Clapeyron equation
• Phase diagram; the concept of critical points and triple points
• Osmotic pressure
• Raoult's law
• Quantum mechanical systems
• Surface phenomena
• Nature of metastable states
• Entropy as an arrow of time
• Entropy of the universe
• Free topic (within the scope of the course content)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☑ Workshops
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Preparation of a term seminar work. Class participation.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">
<table>
<tr><td>Class attendance</td><td>3.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2.5</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>2.5</td><td>Project</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Twice during the semester, students take a written pre-exam (first part: including “Entropy”, the second part: from “Entropy” on). Students that reach more than 50% of possible points were acquitted of taking the written exam and can access the oral exam directly. Furthermore, those students that in the first written pre-exam achieve 50% points or more, can take the oral exam in two parts (first part includes materials up to “The third law of thermodynamics”, must be taken immediately after the first written pre-exam). The final grade is based on written (pre-)exam (40% of the score), the seminar essay (15% of the score) and the oral exam (45% of the score).</td></tr>
<tr><td>Required literature</td><td colspan="3">
<table>
<tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr>
<tr><td>P. Županović: Termodinamika s elementima statističke fizike, Element, Zagreb, 2016.</td><td>25</td><td></td></tr>
</table>
</td></tr>
<tr><td>Supplementary literature</td><td colspan="3">[1] H. D. Young, R. A. Freedman, Sears and Zemansky's university physics: with modern physics, 13th ed., Addison Wesley, 2012.
[2] P. Kulišić, Mehanika i toplina, Školska knjiga, Zagreb 2005</td></tr>
<tr><td>Quality assurance</td><td colspan="3">1. Lecturers who have subjects with correlated learning outcomes work together to ensure quality of learning.
2. Statistics of test scores and assessment of performance in accordance with established learning outcomes.
3. Evaluation of students through an anonymous survey conducted in accordance with the regulations of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Irreversible Process Thermodynamics		
ID	PMP20C	Study year	2.
Lecturer	izv. prof. dr. sc. Larisa Zoranić	Points value (ECTS)	6.0
Associates		Class execution (number of hours in semester)	L: 45, S: 0, E: 15, P: 0
Subject status	Elective	Online percentage	0%

Subject description

Subject goals	Get acquainted with the physical description of non-equilibrium processes through thermodynamics and statistical physics and its application in the research of biological systems.
Enrolment requirements	Outcomes of undergraduate studies, especially related to equilibrium thermodynamics, statistical physics and classical mechanics.
Learning outcomes	After successfully completing the course, the student will be able to: 1. recognize and define the basic concepts of non-equilibrium thermodynamics 2. derive the mass, energy and momentum transfer equations for ideal and non-ideal fluids 3. derive the entropy transfer equation and discuss the production of entropy 4. define the basic postulates of the linear approach in non-equilibrium thermodynamics, and establish and apply Onsager's relations 5. discuss non-equilibrium processes such as diffusion, thermal conductivity and chemical reactions 6. apply a statistical-mechanical approach in the description of non-equilibrium phenomena 7. recognize the importance of applying the ideas of non-equilibrium thermodynamics and statistical mechanics in the research of biological systems and beyond
Syllabus	The timetable worked out according to the weekly plan: 1. Introduction to the course, equilibrium thermodynamics, system, state, process, properties, thermodynamic laws, entropy, direction of time 2. Irreversible and reversible processes, concept of local equilibrium, equilibrium and stability 3. Mass transfer equation, energy transfer equation, balance equations 4. Entropy transfer equation, rate of entropy generation (entropy production), dissipative function, thermodynamic coupling, Benard cell example of dissipative structure 5. Ideal fluids, Euler equation, adiabatic equation, conditions for equilibrium and stability (convection), stationary state 6. Energy transfer equation, momentum transfer equation, incompressible fluids, viscous fluids, Navier-Stokes equation 7. Energy transfer equation with viscosity, energy dissipation, heat transfer equation 8. Diffusion, relaxation time, examples of thermodynamic coupling 9. Postulates of linear non-equilibrium thermodynamics, entropy production equation, stationary state 10. Linear relationship between flow and force, Onsager relations, examples of coupling of heat transfer and diffusion 11. Time variation of entropy production, principle of minimum entropy production 12. Statistical-mechanical approach, Brownian motion, Langevin equation 13. Stochastic processes, Fokker-Planck equation 14. Fluctuation-dissipation theorem 15. Elective topic, applications in biophysics, economics, chemical kinetics and the like.
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Attendance and commitment of students in class, solving tasks in class and at home. Participation in class discussions and debates.

Monitoring student work						
	Class attendance	2	Research		Practical work	
	Experimental work		Paper			

<table>
<tr><td rowspan="3"></td><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>1.5</td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Knowledge is tested by a written and oral exam. Colloquiums are organized during classes. Students who do not pass the written part through the colloquium have 4 additional exam deadlines for passing the written part. The oral exam is taken after passing the written part in the form of a written and oral presentation of the seminar.</td></tr>
<tr><td rowspan="4">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">Nonequilibrium Thermodynamics Transport and Rate Processes in Physical, Chemical and Biological Systems, Yasar Demirel, 2014 Elsevier B.V.</td><td></td><td>online</td></tr>
<tr><td colspan="4">Fluid mechanics L.D. Landau and E. M. Lifshizt, Volume 6 of Course of Theoretical Physics, Pergamon press 1987.</td><td></td><td>online</td></tr>
<tr><td colspan="4">Statistical mechanics-3rd ed. R. K. Pathria, Paul D. Beale, 2011 Elsevier Ltd.</td><td></td><td>online</td></tr>
<tr><td>Supplementary literature</td><td colspan="6">Modern thermodynamics, from heat engines to dissipative structures D. Kondepudi, I. Prigogine: JOHN WILEY AND SONS, 1998.
P. Županovic: Thermodynamics with elements of statistical physics, Element, Zagreb, 2016.
Scientific articles, lectures</td></tr>
<tr><td>Quality assurance</td><td colspan="6">The success of the program is monitored by the quality of knowledge demonstrated in the exams as well as by assessing the enthusiasm shown for the subject.
External evaluation includes student surveys.
Statistics of exam results and student evaluation through an anonymous survey on
at the end of the course performance. The survey is conducted according to the rules of the University of Split</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="7">Tjelesna i zdravstvena kultura II</td></tr>
<tr><td>ID</td><td>PMS132</td><td>Study year</td><td colspan="5">1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Mladen Hraste</td><td>Points value (ECTS)</td><td colspan="5">1.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td colspan="2">P</td></tr>
<tr><td>0</td><td>0</td><td>30</td><td colspan="2">0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="5">0%</td></tr>
<tr><td colspan="8">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="7">Osnovni su ciljevi predmeta da se optimalizacijom svih antropoloških obilježja studenata očuva i unaprijedi njihovo zdravlje, podigne kvaliteta njihovog života i studiranja te stekne trajna navika i običaj za tjelovježbom.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="7">Nema uvjeta za upis predmeta. Nema ulaznih kompetencija.</td></tr>
<tr><td>Learning outcomes</td><td colspan="7">Student će nakon odsluanog kolegija biti u stanju: o boljeg mentalnog i fizičkog zdravlja o očuvati i razviti zdravstveni status primjenom tjelovježbe o provoditi tjelesno aktivan način života o promicati vrijednosti aktivnoga i zdravoga načina života.</td></tr>
<tr><td>Syllabus</td><td colspan="7">1. nastavna tema (2 sata): učenje i usavršavanje biotičkih kretnih struktura 1; razvijanje i održavanje aerobnih sposobnosti
2. nastavna tema (2 sata): učenje i usavršavanje biotičkih kretnih struktura 2; razvijanje i održavanje aerobnih sposobnosti
3. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i/ili učenje i usavršavanje osnovnih kretnih struktura odabrane kineziološke aktivnosti; razvijanje i održavanje aerobnih sposobnosti
4. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i/ili učenje i usavršavanje specifičnih kretnih struktura odabrane kineziološke aktivnosti; razvijanje i održavanje aerobnih sposobnosti
5. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i/ili učenje i usavršavanje osnovnih tehničkih elemenata 1 odabrane kineziološke aktivnosti; razvijanje i održavanje aerobnih sposobnosti
6. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i ili učenje i usavršavanje osnovnih tehničkih elemenata 2 odabrane kineziološke aktivnosti; razvijanje i održavanje aerobnih sposobnosti
7. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i/ili učenje i usavršavanje osnovnih tehničkih elemenata 3 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
8. nastavna tema (2 sata): učenje i usavršavanje fitness programa 2 i/ili učenje i usavršavanje osnovnih tehničkih elemenata 4 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
9. nastavna tema (2 sata): učenje i usavršavanje fitness programa 2 i/ili učenje i usavršavanje osnovnih taktičkih elemenata 1 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
10. nastavna tema (2 sata): učenje i usavršavanje fitness programa 2 i/ili učenje i usavršavanje osnovnih taktičkih elemenata 2 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
11. nastavna tema (2 sata): učenje i usavršavanje fitness programa 2 i/ili učenje i usavršavanje osnovnih taktičkih elemenata 3 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
12. nastavna tema (2 sata): učenje i usavršavanje fitness programa 3 i/ili učenje i usavršavanje osnovnih taktičkih elemenata 4 odabrane kineziološke aktivnosti; razvijanje i održavanje anaerobno alaktatnih sposobnosti
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13. nastavna tema (2 sata): učenje i usavršavanje fitness programa 3 i/ili učenje i usavršavanje kompleksnih tehničkih elemenata 1 odabrane kineziološke aktivnosti; razvijanje i održavanje anaerobno alaktatnih sposobnosti
14. nastavna tema (2 sata): učenje i usavršavanje fitness programa 3 i/ili učenje i usavršavanje kompleksnih tehničkih elemenata 2 odabrane kineziološke aktivnosti; razvijanje i održavanje anaerobno alaktatnih sposobnosti
15. nastavna tema (2 sata): učenje i usavršavanje fitness programa 3 i/ili učenje i usavršavanje kompleksnih taktičkih elemenata 1 odabrane kineziološke aktivnosti; razvijanje i održavanje anaerobno alaktatnih sposobnosti</td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars</td><td colspan="3">☐ Fieldwork
☐ Individual assignments</td><td colspan="3">☐</td></tr>
</table>

	☑ Exercises ☐ Fully online ☐ Combined online	☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐
Student obligations	Studenti su obvezni prisustvovati minimalno 24 od ukupno 30 predviđenih sati (80%)		

Monitoring student work	Class attendance	1	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project			

Assessment and evaluation of student work	Kolegij se ne ocjenjuje. Studentu se tijekom nastave pozitivno vrjednuje motoričko gibanje ako ga izvodi bez greške, lako i skladno; bez greške, lako i skladno, ali malo “tvrđe”; s manjim greškama i uz manje poteškoće . Studentu se tijekom nastave pozitivno ne vrjednuje motoričko gibanje ako ga izvodi s velikim greškama i uz velike poteškoće ili ne može izvesti motorički zadatak ni u elementarnom obliku		
Required literature	Title	Number of copies available	Availability on other medium
	–		
Supplementary literature	http://www.pmfst.hr/~mhraste/ Priručnik iz kolegija Tjelesna i zdravstvena kultura		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Tjelesna i zdravstvena kultura I</td></tr>
<tr><td>ID</td><td>PMS131</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Mladen Hraste</td><td>Points value (ECTS)</td><td>1.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 0
S: 0
E: 30
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Osnovni su ciljevi predmeta da se optimalizacijom svih antropoloških obilježja studenata očuva i unaprijedi njihovo zdravlje, podigne kvaliteta njihovog života i studiranja te stekne trajna navika i običaj za tjelovježbom</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Nema uvjeta za upis predmeta. Nema ulaznih kompetencija.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Student će nakon odslušanog kolegija biti u stanju: o boljeg mentalnog i fizičkog zdravlja o očuvati i razviti zdravstveni status primjenom tjelovježbe o provoditi tjelesno aktivan način života o promicati vrijednosti aktivnoga i zdravoga načina života</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. nastavna tema (2 sata): učenje i usavršavanje biotičkih kretnih struktura 1; razvijanje i održavanje aerobnih sposobnosti
2. nastavna tema (2 sata): učenje i usavršavanje biotičkih kretnih struktura 2; razvijanje i održavanje aerobnih sposobnosti
3. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i/ili učenje i usavršavanje osnovnih kretnih struktura odabrane kineziološke aktivnosti; razvijanje i održavanje aerobnih sposobnosti
4. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i/ili učenje i usavršavanje specifičnih kretnih struktura odabrane kineziološke aktivnosti; razvijanje i održavanje aerobnih sposobnosti
5. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i/ili učenje i usavršavanje osnovnih tehničkih elemenata 1 odabrane kineziološke aktivnosti; razvijanje i održavanje aerobnih sposobnosti
6. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i ili učenje i usavršavanje osnovnih tehničkih elemenata 2 odabrane kineziološke aktivnosti; razvijanje i održavanje aerobnih sposobnosti
7. nastavna tema (2 sata): učenje i usavršavanje fitness programa 1 i/ili učenje i usavršavanje osnovnih tehničkih elemenata 3 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
8. nastavna tema (2 sata): učenje i usavršavanje fitness programa 2 i/ili učenje i usavršavanje osnovnih tehničkih elemenata 4 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
9. nastavna tema (2 sata): učenje i usavršavanje fitness programa 2 i/ili učenje i usavršavanje osnovnih taktičkih elemenata 1 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
10. nastavna tema (2 sata): učenje i usavršavanje fitness programa 2 i/ili učenje i usavršavanje osnovnih taktičkih elemenata 2 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
11. nastavna tema (2 sata): učenje i usavršavanje fitness programa 2 i/ili učenje i usavršavanje osnovnih taktičkih elemenata 3 odabrane kineziološke aktivnosti; razvijanje i održavanje mješovitih aerobno-anaerobnih sposobnosti
12. nastavna tema (2 sata): učenje i usavršavanje fitness programa 3 i/ili učenje i usavršavanje osnovnih taktičkih elemenata 4 odabrane kineziološke aktivnosti; razvijanje i održavanje anaerobno alaktatnih sposobnosti
162 Preddiplomski sveučilišni studij Fizika
13. nastavna tema (2 sata): učenje i usavršavanje fitness programa 3 i/ili učenje i usavršavanje kompleksnih tehničkih elemenata 1 odabrane kineziološke aktivnosti; razvijanje i održavanje anaerobno alaktatnih sposobnosti
14. nastavna tema (2 sata): učenje i usavršavanje fitness programa 3 i/ili učenje i usavršavanje kompleksnih tehničkih elemenata 2 odabrane kineziološke aktivnosti; razvijanje i održavanje anaerobno alaktatnih sposobnosti
15. nastavna tema (2 sata): učenje i usavršavanje fitness programa 3 i/ili učenje i usavršavanje kompleksnih taktičkih elemenata 1 odabrane kineziološke aktivnosti; razvijanje i održavanje anaerobno alaktatnih sposobnosti</td></tr>
<tr><td>Teaching types</td><td>☐ Lectures
☐ Seminars</td><td>☐ Fieldwork
☐ Individual assignments</td><td>☐</td></tr>
</table>

	☑ Exercises ☐ Fully online ☐ Combined online	☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐
Student obligations	Studenti su obvezni prisustvovati minimalno 24 od ukupno 30 predviđenih sati (80%)		

Monitoring student work						
	Class attendance	1	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam		Project			

Assessment and evaluation of student work	Kolegij se ne ocjenjuje. Studentu se tijekom nastave pozitivno vrjednuje motoričko gibanje ako ga izvodi bez greške, lako i skladno; bez greške, lako i skladno, ali malo “tvrđe”; s manjim greškama i uz manje poteškoće . Studentu se tijekom nastave pozitivno ne vrjednuje motoričko gibanje ako ga izvodi s velikim greškama i uz velike poteškoće ili ne može izvesti motorički zadatak ni u elementarnom obliku

Required literature	Title	Number of copies available	Availability on other medium
	http://www.pmfst.hr/~mhraste/ Priručnik iz kolegija Tjelesna i zdravstvena kultura		

Supplementary literature	
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="6">Shellfish toxicity</td></tr>
<tr><td>ID</td><td>PMB535</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Stjepan Orhanović</td><td>Points value (ECTS)</td><td colspan="4">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>15</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">10%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Getting acquainted with the issue of bivalve toxicity in the natural environment and cultivation sites
Getting acquainted with the symptoms of poisoning after consumption of toxic bivalve molluscs.
Getting to know the extent of the risk of occurrence and accumulation of biotoxins and other pollutants in bivalve mollusc.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Courses taken: General Chemistry, Cell Biology, General Zoology</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">– Understand the causes of shellfish toxicity and the transfer of dangerous substances through the food chain,
– understand the role of phytoplankton in the marine ecosystem,
– explain the importance of shellfishing in the economy,
– define the poison, explain the toxicological and pharmacological effects of the poison and the interaction of poisons with the chemical and morphological structures of the organism,
– explain the processes of the interaction of poisons with other substances that are brought into the organism
– recognize symptoms of sea biotoxin poisoning,
– perform a risk assessment calculation for marine toxins,
– link information related to the maximum permissible amounts of marine biotoxins in food,
– explain the global spatial distribution of toxicity and define areas characterized by certain types of toxicity,
– understand the traceability principle (at official controls) from sampling to analysis results.</td></tr>
<tr><td>Syllabus</td><td colspan="6">Lecture 1. Causes of bivalve toxicity
Causes of shellfish toxicity, transmission of dangerous substances through the food chain, characteristics and role of phytoplankton, phytoplankton categories, spatial and seasonal distribution of phytoplankton, dangerous phytoplankton blooms.

Lecture 2. Types of bivalve toxicity
Types of bivalve toxicity, PSP toxicity type, NSP toxicity type, DSP toxicity type, ASP toxicity type, Ciguatera type of toxicity (fish), cyanobacterial toxicity type.

Lecture 3. Commercial importance of bivalve molluscs
Shellfish cultivation in Croatia, monitoring the quality of sea and bivalve molluscs in the Republic of Croatia, ordinance on veterinary and health conditions for the production, cultivation, purification and marketing of bivalve molluscs.

Lecture 4. Spatial and temporal distribution of toxicity.
Global spatial distribution of toxicity. Areas susceptible to certain types of toxicity. Seasonality of reporting toxicity.
Lecture 5. Basics of toxicology
Basic toxicological components, elementary toxins and their mixtures, sources of poisoning, reversible and irreversible effects in the body, interactions of poisons.

Lecture 6. DSP toxins
Division of natural toxins in the sea according to the mode of action on man, the influence of toxins on bivalve mollusks, chemical structure, properties and mechanism of action of DSP toxins, derivatives of DSP toxins, toxicology of azasppiracids (AZA) and yessotoxins (YTX). Symptoms of DSP toxin poisoning. Biological and instrumental methods of toxins determination in phytoplankton samples and soft shellfish tissue. Basic principles of operation of mass spectrometry technique linked to liquid chromatography. Cases of DSP toxins in the world and in Croatia. Calculation of risk assessment for DSP toxins. European and Croatian</td></tr>
</table>

legislation related to DSP toxins in bivalve mollusks.

Lecture 7.ASP toxins
Chemical structure, properties and mechanisms of action of ASP toxins, derivatives of ASP toxins. Symptoms of ASP toxin poisoning. Instrumental methods of determination in phytoplankton samples and soft shellfish tissue. Risk assessment factors for ASP toxins. Cases of ASP toxins in the world and in Croatia. Calculation of risk assessment for ASP toxins. European and Croatian legislation related to ASP toxins in bivalve mollusks.

Lecture 8. PSP toxins
Chemical structure, properties and mechanisms of action of PSP toxins, categories of PSP toxins according to chemical structure and relative toxicity. Mild, moderately severe and severe symptoms of PSP toxin poisoning. Biological and instrumental methods of determination in phytoplankton samples and soft shellfish tissue. Risk assessment factors for PSP toxins. Cases of PSP toxins in the world and in Croatia. Calculation of risk assessment for PSP toxins. European and Croatian legislation related to PSP toxins in bivalve mollusks.
Lecture 9. NSP toxins and tetrodotoxins
Toxicity, toxicity levels and tetrodoxxin distribution. Recorded cases of tetradotoxin poisoning in the world. Chemical structure, properties and mechanism of action of NSP toxins. Symptoms of NSP toxin poisoning. Distribution of NSP toxins. Shortcomings and advantages of biological methods of determining toxins.

Lecture 10. Monitoring of farms and areas of shellfish cultivation, European and Croatian legislation
Sea and shellfish quality monitoring plan, traceability principle (at official controls) from sampling to analysis results.

Teaching types			
	☑ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐

Student obligations	
	Pohađanje predavanja u iznosu od najmanje 70% predviđene satnice.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam	1	Project			

Assessment and evaluation of student work

Students are evaluated on the basis of a written exam (or 2 partial written colloquium)
Colloquium or exam evaluation criteria (score scale):
% of evaluation test solution
<60 insufficient (1)
60 -70 sufficient (2)
71-80 good (3)
81-90 very good (4)
91-100 excellent (5)

Required literature

Title	Number of copies available	Availability on other medium
Luis M. Botana (2000) Seafood and Freshwater Toxins, Pharmacology, Physiology and Detection, Marcel Dekker, Inc. New Yor		chemistrychemists.com /.../Toxicology/seafoodandfreshwatertoxins2000.pdf
Priručnik-Hrvatska agencija za hranu (2015). Prirodni toksikanti - toksikanti biljnog podrijetla. Hrvatska agencija za hranu,		https://www.hah.hr/doc/prirucnik.doc.

	Skoog D.A., West D.M i Holler F.J. (1999) Osnove Analitičke kemije, Školska knjiga, Zagreb, prvo izdanje		
	Ujević, I., Ž. Ninčević-Gladan, R. Roje, S. Skejić, J. Arapov, I. Marasović (2010) Domoic acid - a new toxin in the Croatian Adriatic shellfish toxin profile Molecules, 15: 6835-6849		http://www.mdpi.com/1420-3049/15/10/6835
	Roje-Busatto, R. & Ujević I. (2014) PSP Toxins Profile in Ascidian Microcosmus vulgaris (Heller, 1877) after Human Poisoning in Croatia (Adriatic Sea). Toxicon. 79: 28-36		http://bib.irb.hr/datoteka/670657.1-s2.0-S0041010114000051-main.pdf
	Ujević, I., Roje, R., Ninčević-Gladan, Ž., Marasović, I.First report of Paralytic Shellfish Poisoning (PSP) in mussels (Mytilus galloprovincialis) from eastern Adriatic Sea (Croatia). Food Control. 25 (2012)19		http://bib.irb.hr/datoteka/533541.JFCO2455_FoodControl.pdf
	Narodne novine, broj 117/04. Pravilnik o veterinarsko-zdravstvenim uvjetima za izlov, uzgoj, pročišćavanje i stavljanje u promet živih školjkaša.		www.propisi.hr/print.php?id=3853
Supplementary literature	-Hallegraef, G.M. (1993) A review of harmful algal blooms and their apparent global increase. Phycologia, 32: 79-99 -Falconer, J.R. 1993. Algal Toxins in Seafood and Drinking Water. University press, Cambridge, pp. 224		
Quality assurance	- Active participation in class - Student survey of evaluation of teachers' work and subject. - Feedback from students at the consultation		
Other (in the opinion of the proponent)	-Consultations are taking place according to agreement with students by prior notice or on e-mail: stipe@pmfst.hr		

Subject name	Toxicology					
ID	PMB735	Study year	1.			
Lecturer	doc. dr. sc. Viljemka Bučević Popović	Points value (ECTS)	3.0			
Associates		Class execution (number of hours in semester)	L	S	E	P
			30	0	0	0
Subject status	Elective	Online percentage	10%			

Subject description

Subject goals	Getting acquainted with the basic principles of toxicology and the toxicological properties of selected groups of harmful substances.
Enrolment requirements	There are no prerequisites for enrolment. Entry competencies required for following the course successfully: – knowledge of the chemical properties of inorganic and organic compounds – knowledge of the structure and functioning of the main organ systems in human body
Learning outcomes	After completing the course, the student will be able to: –Compare the main pathways for absorption of toxic substances into the human body, their distribution, metabolism and excretion. –Interpret dose and effect ratio, distinguish acute from chronic toxicity, classify harmful substances according to toxicological data –Assess the toxicity of different groups of substances (gases, solvents, metals, etc.) –Apply protective measures against chemicals in laboratory work –Discuss effects of potentially harmful substances in the everyday environment (pesticides, natural toxins, nutritional supplements, etc.)
Syllabus	Lectures: 1. Toxicology – description and history. (1 hour) 2. Absorption of harmful substances into the human body. Distribution and excretion of harmful substances (3 hours) 3. Biotransformation: phase I and phase II reactions. Exposure to toxic substances. (3 hours) 4. Dose-Effect Ratio. Types of adverse effects – general toxicity. (1 hour) 5. Classification of harmful substances. (1 hour) 6. Mutagenicity and carcinogenicity. (2 hours) 7. Reproductive toxicity. Ecotoxicity. (2 hours) 8. Risk Assessment, Danger and Safety. (1 hour) 9. Toxic effect of gases: suffocants and irritants. (2 hours) 10. Toxic effects of metals and metal containing substances. (2 hours) 11. Toxic organic substances. (4 hours). 12. Harmful effects of ionizing radiation. (2 hours) 13. Protection measures against harmful chemicals in laboratory. (2 hours) 14. Selected examples of exposures to harmful substances in everyday life. (4 hours)
Teaching types	☑ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring
Student obligations	Attending classes, seminar on selected topic, exam

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work	0	Paper			
Essay		Seminar paper	0.5		
Colloquiums		Oral exam	1.5		
Written exam		Project			

Assessment and evaluation of student work	20% seminar 80% exam

Required literature

Title	Number of copies available	Availability on other medium

	Lectures as pdf files.		
Supplementary literature	C.D. Klaassen (ur.), Casarett and Doull's Toxicology - The Basic Science of Poisons., 6. izd., McGraw-Hill, 2001.		
Quality assurance	The quality of teaching will be monitored by collecting feedback from students through personal consultations, joint conversations and anonymous student surveys. The students' performance in the final exam will be analyzed and used to improve the teaching performance in the next academic year.		
Other (in the opinion of the proponent)			

Subject name	Three-dimensional design of physical objects		
ID	PMII70	Study year	1.
Lecturer	doc. dr. sc. Ivan Peko	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Elective	Online percentage	0%

Subject description

Subject goals	Introduction to 3D modeling and object design. Students should be able to use tools for 3D modeling and object design.
Enrolment requirements	-
Learning outcomes	1. Introduction to 3D modeling and object design tools 2. 3D object representation: drawing and profile 3. Introduction to projections 4. Mirroring, symmetry and their use in computer design 5. Computer implementation of spline and their use
Syllabus	1. Drawing as a basis for 3D object 2. Profile extrusions & Edit profile 3. Profile and drawings 4. Degrees of freedom and constraints on profile 5. Object rotation and revolution 6. Geometric projections 7. Line construction, Centerline & Mirror 8. Extruded cut 9. Multiple object construction 10. Screws and screw threads 11. Shell 12. 2D and 3D splines and their use 13. Smoothing: chamfers and fillets 14. Introduction to Blender 15. 3D printing
Teaching types	☑ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring
Student obligations	Participate in course activities. Homework. Exam.

Monitoring student work

Class attendance	1	Research		Practical work	1
Experimental work	1	Paper			
Essay		Seminar paper	1		
Colloquiums		Oral exam			
Written exam		Project	1		

Assessment and evaluation of student work	Student activities in class (20%) Project (40%) Exam (40%)

Required literature

Title	Number of copies available	Availability on other medium
Lecture notes in 3D modeling, Hrvoje Kalinić		

Supplementary literature	Lecture notes available on the Internet including solved problems and additional links Matt Lombard: Solidworks 2009 Bible, Wiley Publishing, Inc Dassault Systems Solidworks Corporation: Solidworks 2010, Soldiworks Essentials
Quality assurance	Students feedback, students results and self-evaluation
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Classroom management</td></tr>
<tr><td>ID</td><td>PMS160</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>Antonija Bašić, pred.</td><td>Points value (ECTS)</td><td>2.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 15
S: 15
E: 0
P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Course objectives are training students for high-quality decision-making in the learning process with special emphasis on creating quality teaching atmosphere and environment, acquiring knowledge and skills which can help them prevent and resolve conflicts in a variety of teaching situations and train them for high-quality classroom management as well as for conducting parent-teacher conferences and meetings</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3"></td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon completion of the course, the student will be able to:
1. recognize, differentiate and evaluate different teaching and educational styles
2. understand, analyze and evaluate determinants of quality teaching environment and communication, namely classroom environment
3. define, assess and evaluate characteristics of effective teaching process
4. understand, differentiate and evaluate causes of indiscipline in schools, and ways to motivate students depending on their developmental characteristics
5. understand, differentiate and evaluate ways of achieving discipline in the teaching process taking into account developmental characteristics of students, and improve competences in handling a variety of teaching situations
6. organize high-quality parent-teacher conferences and meetings.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1.The relationship between traditional and modern school with regard to the participants' role in the teaching process, methods of acquiring knowledge and skills; curricular, competence- based and co- constructivist approach to building modern school (2L)
2. features of effective teaching process in modern school (1L)
3. classroom management with respect to developmental characteristics of students (age, gender, social, emotional, health) (2L)
4. teacher's teaching and educational styles (1L)
5. motivation in modern education process (1L)
6. assessment impact on the quality of the classroom environment (1L)
7. characteristics of teaching atmosphere and environment in modern teaching process and in major reform pedagogies (2L)
8. effective teaching communication (1L)
9. Causes of school discipline and establishing discipline in the teaching process (2L)
10. organization of parent - teacher conference
11. parent-teacher meetings (1L)
Seminars are organized as workshops in which students prepare, critically cogitate and discuss issues, current events and problems important for classroom management and plan new strategies of prevention and resolution of detected problems. In the implementation of the seminar active participation, cooperative learning and teamwork are expected from students.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Students are, in accordance with the existing regulations, obliged to participate in all forms of instruction.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance | 1 | Research | | Practical work |</td></tr>
</table>

	Experimental work		Paper			
	Essay		Seminar paper	0.5		
	Colloquiums		Oral exam	0.5		
	Written exam		Project			

Assessment and evaluation of student work	Assessment of knowledge, skills and competence is carried out during the semester by evaluating students' activities during lectures and seminars, including oral examination.

Required literature	Title	Number of copies available	Availability on other medium
	Ilić, I.; Ištvanić, I.; Letica, J.; Sirovatka, G.; Vican, D. (2012), Upravljanje razredom. Zagreb: Agencija za strukovno obrazovanje i obrazovanje odraslih u suradnji s British Councilom.		dostupno
	Vizek Vidović, V.; Rijavec, M.; Vlahović –Štetić, V.; Miljković, D: (2014), Psihologija obrazovanja. Zagreb: IEP VERN. (odabrana poglavlja)		
	Kyriacou, C. (2001), Temeljna nastavna umijeća. Zagreb: Educa. (odabrana poglavlja)		

Supplementary literature	Jensen, E. (2003), Super nastava. Zagreb: Educa. Glasser, W. (1995), Nastavnik u kvalitetnoj školi. Zagreb: Educa. Ajduković, M.; Pečnik, N. (20029, Nenasilno rješavanje sukoba. Zagreb: Alinea. Bičanić, J. (20019, Vježbanje životnih vještina. Priručnik za razrednike. Zagreb: Alinea Matijević, M. (2001), Alternativne škole. Zagreb: Tipex. Matijević, M.; Radovanović, D. (2011), Nastava usmjerena na učenika. Zagreb: Školske novine.
Quality assurance	Advisory hours, conversation, active participation, evaluation conducted by the Quality Assurance Board
Other (in the opinion of the proponent)	

Subject name	Introduction to Atomic and Molecular Physics						
ID	PMP204	Study year	1.				
Lecturer	doc. dr. sc. Martina Požar	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	30	0	0	
Subject status	Compulsory	Online percentage	20%				

Subject description	
Subject goals	Understanding atomic and molecular structure, and how it manifests itself in spectra. Understanding how symmetry can be applied to objects like molecules and how group theory can help us predict the normal modes of molecules
Enrolment requirements	Learning outcomes planned for the subjects: General physics; Quantum physics.
Learning outcomes	1. To understand group theory and apply it to the calculation of normal modes of molecules, hybridization of molecular orbitals 2. To derive and use the results of angular momentum algebra. 3. To describe and analyze the spectrum of hydrogen atoms and compare it with other spectra alkaline elements. 4. To understand the electronic structure of atoms and the processes that take place there, with the aim of interpreting the spectrum. 5. To analyze the interaction of atoms with stationary and homogeneous electrical and magnetic fields. 6. To discuss the basic properties of atomic and molecular orbitals. To calculate the electronic structure of molecules, understand the construction of molecular orbitals and the hybridization of molecular orbitals 7. To describe common experimental techniques and measuring instruments in atomic and molecular physics and applications of atomic and molecular physics in others branches of physics and areas of science. 8. To describe the nature of various molecular degrees of freedom. 9. To draw conclusions about the atomic and molecular structure based on the provided spectra.
Syllabus	1. Group theory: introduction. Symmetry operations, multiplication table. 2. Group theory: C2V - example of water. Matrix representations of symmetry operations, character table. Great and little orthogonality theorems. 3. Group theory: character table and application to the water molecule. Normal modes of the water molecule and the spectrum. C3V - example of ammonia. 4. Group theory: C3V - example of ammonia. SALC. Character table. Normal modes of the ammonia molecule and spectrum. 5. Group theory: Td - example of methane, normal modes. Using hodograms on examples. 6. Theory of groups: Direct product groups. Projection operator. Vanishing integrals. 7. Angular momentum: spin. Bonded and unbonded bases. 8. Atomic structure and spectrum: Hydrogen atom. SO bonding. 9. Atomic structure and spectrum: Hydrogen atom - detailed spectrum, terms. 10. Atomic structure and spectrum: Helium atom - detailed spectrum, terms. 11. Atomic structure and spectrum: Spectral terms for atoms with more electrons. Transitions, selection rules. Hund's rules. Normal Zeeman effect. 12. Atomic structure and spectrum: Paschen-Back effect. Stark effect. 13. Molecular structure and spectrum: Born-Oppenheimer approximation. H2+ molecule. Theory of molecular orbitals. 14. Molecular structure and spectrum: Diatomic molecules. Hybridization of orbitals (group theory). 15. Molecular structure and spectrum: Huckel's method.

Teaching types			
	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐

Student obligations	Attending classes. Preparing and presenting the seminar paper. Passed written exam (exercises) and oral exam (theoretical explanations). Success in each part at least 40%.

Monitoring student work	Class attendance	2	Research		Practical work	

<table>
<tr><td rowspan="4"></td><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>1</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Students' work is evaluated through: the creation and presentation of a seminar paper, a written exam and an oral exam.</td></tr>
<tr><td rowspan="3">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">P. Atkins, R. Friedman: Molecular Quantum Mechanics, Oxford, 2007.</td><td></td><td></td></tr>
<tr><td colspan="4">N. Zettilli, „Quantum Mechanics: Concepts and Applications”, Wiley & sons, 2001.</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">A. Vincent, „Molecular Symmetry and Group Theory”, Wiley & sons, 2013.

P. Atkins, J. De Paula, R. Friedman, „Quanta, Matter, and Change: A Molecular Approach to Physical Chemistry”, Oxford University Press, 2008.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Regular verification of the achievement of the expected learning outcomes during classes.

Statistics of exam results and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the rules of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="6">Introduction to differential geometry</td></tr>
<tr><td>ID</td><td>PMM120</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Tea Martinić Bilać</td><td>Points value (ECTS)</td><td colspan="4">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">30%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Goal of this course is to familiarize students with basic terms of differential geometry such as theory of curves in space (and on plane) and theory of surfaces in Euclid space. Thus, students will be able to understand more advanced course in differential geometry which would contain Riemann geometry and multiplicity. Furthermore, application of acquired knowledge is possible in other science fields, eg. in physics.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Required competences: knowledge of mathematical analysis and linear algebra.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Student will be able to:

–define regular curves and surfaces

–explain curvature and torsion of a curve

–apply first and second fundamental form of surface

–analyse surface using normal, Gaussian and mean curvature</td></tr>
<tr><td>Syllabus</td><td colspan="6">–Regular curve (1)

–Lengths of curves (1)

–Curvature and torsion (2)

–Frenet formuleas (2)

–Fundamental theorem of space curves (2)

–Regular surfaces (1)

–Tangent plane to regular surface (2)

–First fundamental form of surface. (2)

–Orientation of surface (1)

–Second fundamental form of surface. (2)

–Normal curvature (2)

–Gaussian and mean curvature (2)

–Special curves on surfaces: line of curvature, asymptotic curve and geodesic. (2)

–Locally isometric surfaces (2)

– Theorema Egregium. (2)

– Fundamental theorem of surfaces in space (2)

– Gauss-Bonnet theorem. (2)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="4">☐
☐
☐
☐</td></tr>
<tr><td></td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Student obligations</td><td colspan="6">Attending classes and homework assignments.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>2</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Written and oral exam.</td></tr>
<tr><td rowspan="2">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">N. Ujević, Predavanja iz uvoda u diferencijalnu geometriju, skripta.</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">1.M. P. Do Carmo, Differential Geometry of Curves and Surfaces, Prentice-Hall, 1976.

2.R.S. Millman, G.D. Parker, Elements of Differential Geometry, Prentice-Hall Inc., New Jersey/London, 1977.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Introduction to financial mathematics</td></tr>
<tr><td>ID</td><td>PMM505</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>dr. sc. Ana Perišić</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">An introduction to fundamental concepts of financial mathematics required for understanding and correct interpretation of mathematical models in finance. Acquiring essential financial modelling skills through presentation of applied mathematical techniques in financial practice covered by many examples.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3"></td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Students will be able to:

– explain the concept of the time value of money,
– differentiate between nominal, proportional and effective interest rate,
– calculate and interpret present and future values of cash flows,
– construct amortization schedules for different loan repayment methods,
– apply basic capital budgeting techniques and compare investment projects,
– evaluating bonds and bond portfolios,
– explain basic concepts of financial derivatives, arbitrage and replicating portfolio,
– carrying out basic calculations in financial mathematics in a computer-supported way.
– model and solve basic problems in economics and finance.</td></tr>
<tr><td>Syllabus</td><td colspan="3">Lectures/Exercises:
1. Time value of money, simple and compound interest types of interest rates. (3)
2. Present and future values of cash flows; general annuities, perpetuities. (3)
3. Continuously compounded interest. (2)
4. Loan. Different loan repayment methods. Rescheduled loans. (3)
5. Intercalary interest. Effective interest. (2)
6. Partial exam. (1)
7. Capital budgeting techniques. Return. (3)
8. Bond: value, price, yield. (2)
9. Duration. Duration of a portfolio of bonds. (2)
10. Immunization. Convexity. (2)
11. Term structure of interest rates. (1)
12. Arbitrage. (1)
13. Financial derivatives, replicated portfolio. (3)
14. Partial exam. (1)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending lectures, writing homework, written and oral exam.
During the semester, students have the possibility to partially take written exams through colloquia (twice during the semester). Students who pass both colloquia don't need to take part in the written exam.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance | Research | Practical work
Experimental work | Paper |
Essay | Seminar paper |
Colloquiums | Oral exam |
Written exam | Project |</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3"></td></tr>
<tr><td>Required literature</td><td>Title</td><td>Number of copies</td><td>Availability on other medium</td></tr>
</table>

		available	
	J. Cvitanić, F. Zapatero, Economics and Mathematics of Financial Markets, The MIT Press, 2004		
	S. Benninga, Financial modeling, 3rd ed, The MIT Press, Cambridge, 2008		
	Šegota, A. Financijska matematika, Sveučilište u Rijeci, 2012.		
	Babić, Z., Tomić-Plazibat, N., Poslovna matematika, Ekonomski fakultet, Split, 2004.		

Supplementary literature	J. Cvitanić, F. Zapatero, Economics and Mathematics of Financial Markets, The MIT Press, 2004 S. Benninga, Financial modeling, 3rd ed, The MIT Press, Cambridge, 2008 Šegota, A. Financijska matematika, Sveučilište u Rijeci, 2012. Babić, Z., Tomić-Plazibat, N., Poslovna matematika, Ekonomski fakultet, Split, 2004.
Quality assurance	Summarizing test results and conducting an anonymous student survey at the end of the course. The survey is conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

Subject name	Introduction to Physics						
ID	PMP096	Study year	1.				
Lecturer	doc. dr. sc. Martina Požar	Points value (ECTS)	4.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			45	0	15	0	
Subject status	Compulsory	Online percentage	0%				

Subject description	
Subject goals	Acquire knowledge and understanding of the basics in mechanics, physics of condensed matter, optics and quantum physics. Acquire computational knowledge in solving physical problems and develop competence in construction of mathematical models for real mechanical problems
Enrolment requirements	Enrollment in the 1st year of undergraduate study
Learning outcomes	Upon passing the course on Introduction to physics, the student will be able to: 1. demonstrate knowledge of the kinematics of motion in one, two and three dimensions; 2. identify and explain Newton's laws of motion and apply them in numerical problems; 3. explain the concepts of work , kinetic and potential energy, momentum and impulse and apply the laws of conservation of energy and momentum in realistic examples; 4. demonstrate knowledge of kinematics and dynamics of rigid bodies rotations and solve simple problems involving the rotation of a rigid body; 5. identify and explain Newton's law of gravitation and Kepler's laws and apply them in the description of the Solar system 6. identify and explain the properties of solids, liquids and gases and solve problems in hydromechanics; 7. explain the motion of a simple harmonic oscillator and describe the propagation of waves, the interference, the resonance and the Doppler effect; 8. demonstrate the knowledge of optics in solving problems; 9. identify and explain Plack's radiation law and the photoelectric effect.
Syllabus	Lectures per weeks (15 weeks in total): 1. Units and physical quantities (2L+1E) 2. Motion along a straight line (2L+1E) 3. Motion in two or three dimensions (4L+1E) 4. Newton's laws of motion (4L+1E) 5. Applying Newton's laws (3L+1E) 6. Work and kinetic energy (3L+1E) 7. Potential energy and energy conservation (3L+1E) 8. Momentum, impulse, and collisions (3L+1E) 9. Rotation of Rigid Bodies (6L+1E) 10. Newton's law of gravitation and Kepler's laws (2L+1E) 11. Solids, liquids and gases (3L+1E) 12. Oscillations (2L+1E) 13. Waves (2L+1E) 14. Optics (3L+1E) 15. Introduction to Quantum Physics (3L+1E)

Teaching types			
	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online	☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐

Student obligations	
	Students have to attend at least 70% of the lectures and 80% of the exercises. Students have to solve at least 50% from each of the two written partial exams or to solve 50% from the final written exam. Students have to pass an oral exam.

Monitoring student work						
	Class attendance	2	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums		Oral exam	1		

	Written exam	1	Project			

Assessment and evaluation of student work	Contribution to the final grade: 1. written exam (or two partial exams) – 50% 2. oral exam – 50%
Required literature	<table><tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr><tr><td>[1] D. Halliday, R. Resnick, J. Walker, Fundamentals of Physics. 9th Edition, John Wiley, New York 2011.</td><td>21</td><td></td></tr></table>
Supplementary literature	[1] P. G. Hewitt, Conceptual Physics, 12th Edition, Pearson 2010. [2] H. D. Young, R. A. Freedman, Sears and Zemansky's University Physics, 12th Edition, Pearson, 2008
Quality assurance	Statistics of the exam results and student evaluation via an anonymous survey conducted by the University of Split
Other (in the opinion of the proponent)	

Subject name	Introduction to Geophysics		
ID	PMP160	Study year	2.
Lecturer	izv. prof. dr. sc. Jadranka Šepić	Points value (ECTS)	4.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 15, P: 0
Subject status	Elective	Online percentage	30%
Subject description			
Subject goals	Provide knowledge on · History of the Universe and the solar system · The earth structure, tectonic processes, and earthquakes · Ocean properties and ocean dynamics · Atmospheric structure and dynamic		
Enrolment requirements	Prerequisites · Basic physics · Basic chemistry · Basic mathematics		
Learning outcomes	Understanding formation and evolution of the earth and the atmosphere Knowledge on earthquake causes and practical solutions of calculating earthquake's epicenter Calculations of ocean dynamics including tides Understanding algorithms describing atmospheric processes		
Syllabus	1. Space and solar system 1 2. The sun 1 3. Formation of the earth 1 4. The moon and tides 1 5. Radiation laws 1 6. Structure of the earth 2 7. Plate tectonics 1 8. Seismic waves and earthquakes2 9. Seismology instruments 1 10. Main concepts of oceanography 2 11. Properties of the oceans and sea floor1 12. Structure of density, temperature, salinity, and motions in the ocean 2 13. Air-sea interaction 1 14. Winds and wind stress over the ocean 1 15. Oceanic heat budget 2 16. Ocean exploration 1 17. Dominant forces for ocean dynamics and their modelling 1 18. Basic concepts of the atmospheric science 2 19. Atmospheric composition 1 20. Structure of atmospheric density, temperature, and pressure 2 21. Ideal gas law 1 22. Hydrostatic equilibrium in the atmosphere 1 23. Adiabatic processes in the atmosphere1		
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☑ Combined online	☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring	☐ ☐ ☐ ☐
Student obligations	· Written exam · Oral presentation · Oral exam		
Monitoring student work	Class attendance: 1.5 Experimental work: Essay: Colloquiums: Written exam:	Research: Paper: Seminar paper: 0.5 Oral exam: 1 Project:	Practical work: Domaći rad: 1.0
Assessment and evaluation of student work	· Written exam · Oral presentation		

	· Oral exam
Required literature	<table><tr><th>Title</th><th>Number of copies available</th><th>Availability on other medium</th></tr><tr><td>Howell, B. F., Jr., 1978: Introduction to Geophysics. Robert E. Krieger Publishing. 400 pp.</td><td></td><td></td></tr><tr><td>Stewart, R. H., 2008: Introduction to Physical Oceanography. Texas A & M University. 345 pp.</td><td></td><td></td></tr><tr><td>Wallace J. M., and P. V. Hobbs, 2006: Atmospheric Science: An introductory Survey. 2nd ed., Academic Press. 483 pp.</td><td></td><td></td></tr></table>
Supplementary literature	• Ahrens C. D. 2001. Essentials of Meteorology, An Invitation to the Atmosphere, Brooks/Cole Publishing. • Bolt, B.A., Inside the Earth, 1982. W.H. Freeman & Company, San Francisco, 191 pp. • Garland G.D., 1977. The Earth's Shape and Gravity, Pergamon Press, Oxford • Kasumović, M., 1971. Opća i primijenjena geofizika I. dio – Opća geofizika, Sveučilište u Zagrebu, Prirodoslovno-matematički fakultet, Zagreb, 1-148. • Merrill, R.T., McElhinny, M.W. and McFadden, P.L. 1998. The magnetic field of the Earth, Academic Press International Geophysics Series, 63 • Pickard, G.L., and W.J. Emery, 1990: Descriptive Physical Oceanography, An Introduction, 5th Edition, Pergamon Press, New York, 320 pp.
Quality assurance	1. Analysis of the acquired learning outcomes at the end of the class, compared with the work of students. 2. Monitoring the development of students in the subjects who followed the links with the success of the case 3. Other surveys of students
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Introduction to mathematical analysis</td></tr>
<tr><td>ID</td><td>PMM151</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Goran Erceg
dr. sc. Ivan Jelić</td><td>Points value (ECTS)</td><td>8.5</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 45, S: 0, E: 60, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The course objective is to acquaint the student with the properties of the space of real numbers and the concept and properties of sequences and series of real numbers and properties of real-valued functions such as continuity.

In the first part of the course, they will observe the sequences and series of real numbers and examine their convergence.

In the second part of the course, they will systematize the known properties of elementary functions and adopt the concepts of limit value and continuity of a real-valued function of a real variable. This will be applied to the demonstration of claims and proofs of the properties of continuous functions on a segment.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">The student will be able to:

- recognize algebraic and order properties of subsets of real numbers

- distinguish and give examples of convergent and divergent sequences and series of real numbers;

- give examples of subsequences of a given sequence of real numbers

- apply the properties of limits of sequences of real numbers

- apply series convergence tests

- list elementary real-valued functions and determine their domains and images

- find the limit of a function at a point and use this limit to determine continuity of a function in said point

- determine and give examples of continuous and non-continuous functions

- list properties of continuous functions on a segment</td></tr>
<tr><td>Syllabus</td><td colspan="3">The space of real numbers - 6 hours

Sequences and series of real numbers (convergence, limits calculus, subsequences, series convergence tests) - 15 hours

Elementary real-valued functions - 9 hours

Limits and continuity of real-valued functions (definitions and characterizations, limits in the extended space of real numbers, properties of continuous functions) - 15 hours</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☑ On line testovi znanja
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Class and tutorial sessions attendance.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 3 | Research: | Practical work:
Experimental work: | Paper: | Grupni rad: 1</td></tr>
</table>

	Essay		Seminar paper			
	Colloquiums		Oral exam			
	Written exam	4.5	Project			

Assessment and evaluation of student work	At class lectures and tutorial sessions, students will have problem solving sessions (individual and group activity). Also, students will take short quiz tests during lectures and online. Both activities will be valued in the final grade but earning points in thiese activities is not mandatory for finishing the course. The final exam is taken in written and oral form. Passing grade on a written form of the exam is a requirement for taking the oral exam. The exam can be taken partially, during class. .

Required literature	Title	Number of copies available	Availability on other medium
	G. B. Thomas, Thomas' Calculus, Pearson, 2016.,13. izdanje	2	da
	S. Abbott, Understanding analysis, Springer-Verlag, New York, 2016., drugo izdanje	2	da
	B. Guljaš, Matematička analiza 1 i 2, skripta PMF -a u Zagrebu, 2018.		da

Supplementary literature	J. Stewart, D. Clagg, S. Watson, Calculus, Eraly Transcendetals, Cengage Learning, 2021., 8. izdanje R. Larson, B. Edwards, Calculus, Cengage Learning, 2016., 11. izdanje V. Matijević, Matematička analiza 1 i 2, skripta PMF-a u Splitu, 2020.
Quality assurance	During the semester, anonymous surveys will be administered to students to determine which concepts have been least understood thus far, which will help instructors to adapt the course. Statistics of exam results and student evaluation through anonymous questionnaires at the end of the course. The survey will be conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="7">Introduction to Mathematical Logic and Set Theory</td></tr>
<tr><td>ID</td><td>PMM700</td><td>Study year</td><td colspan="4">3.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Goran Erceg
dr. sc. Dino Peran</td><td>Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">20%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">The main goal of this course is to give students a deeper insight into the foundations of mathematics in which Mathematical Logic, and especially one of its areas, axiomatic Set Theory, plays the most important role.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">Entry competences: elementary Set Theory.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Upon successful completion of this course students will be able to:

– evaluate the development of Mathematical Logic in terms of its relation to the foundations of Mathematics, explain and evaluate historical role of Cantor’s naive approach to Set Theory

– define axiomatically Propositional Logic and First Order logic (Propositional Calculus PC and Deductive Calculus DC, Predicate Calculus PC)

– define axiomatically Set Theory using the Zermelo-Frankel system of axioms

– using resolution or tableau test satisfiability, validity and logical consequence, for a given formula find its prenex normal form, disjunctive normal form and conjunctive normal form

– give a formal proof of a formula within a calculus (PC or PD)

– compute cardinality of sets given in various ways

– apply cardinal and ordinal numbers arithmetic and order between cardinals and ordinals

– characterize order types of the sets N, Z, Q and R

– apply transfinite induction</td></tr>
<tr><td>Syllabus</td><td colspan="6">– Introduction: Historical overview (1)

– Propositional Logic: syntax and semantics (2)

– Normal forms (1)

– Propositional Calculus (2)

– Deductive Calculus (2)

– First order theories. syntax and semantics (2)

– Prenex normal form (1)

– Predicate Calculus (1)

– Cantor’s “naive” approach to Set Theory. Paradoxes (1)

– The Zermelo-Frankel system of axioms (2)

– Relations and functions (1)

– Inductive and transitive sets (1)

– The Axiom of choice. The function of choice. A family of sets. The product of set</td></tr>
</table>

	family (1) – Finite and infinite sets (1) – Equipotent sets. Cardinal numbers. The Cantor-Bernstein theorem (1) – Countable sets (1) – Uncountable sets. Continuum. The continuum hypothesis (2) – Partial orders. Total orders. Isomorphisms of ordered sets. Order types (2) – Characterizations of the ordered sets N, Z, Q and R (2) – Well-ordered sets. Ordinal numbers. Transfinite induction. The Buralli-Forti paradox (2)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Attending classes.

Monitoring student work

Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	1	Oral exam	2		
Written exam		Project			

Assessment and evaluation of student work	Two partial written exams / one final written exam and final oral exam.

Required literature

Title	Number of copies available	Availability on other medium
M. Vuković, Matematička logika 1, PMF, Zagreb, 2007.		
V. Matijević, Uvod u teoriju skupova, skripta, PMF, Split, 2014.		
P. Papić, Uvod u teoriju skupova, HMD, Zagreb, 2000.		

Supplementary literature	D. van Dalen, Logic and Structures, Springer-Verlag, 1997. E. Mendelson, Introduction to Mathematical Logic, D. Van Nostrand Company, Inc. Princeton, 1997. H.B. Enderton, Elements of Set Theory, Academic Press, New York, 1977P K. Kuratowski, A. Mostowski, Set Theory, PWN, Warszawa, 1968
Quality assurance	Summary feedback for the whole class after the exam. Anonymous student survey.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Introduction to Fluid Mechanics</td></tr>
<tr><td>ID</td><td>PMP261</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Bernarda Lovrinčević</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>20%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Understanding the physical properties of fluids and their influence on fluid kinematics, accurate application of the law of conservation of mass, momentum and energy to fluid flow, and application of mathematical tools needed to describe fluid flow.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">The student must have adopted the following learning outcomes:
· apply the laws of classical mechanics to a particle system
· apply the laws of conservation of momentum, angular momentum and energy
· solve problems of motion in one dimension and motion in a medium with resistance
· solve physical problems using Lagrange's and Hamilton's formulation of classical mechanics
· define and discuss the laws of thermodynamics
· understand the physical interpretations of differential operators
· use vector analysis in rectangular and curved coordinates
· explain the basics of tensor analysis
· apply methods for solving linear differential equations of the second order</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">· to classify fluids based on their physical properties
· to calculate the kinematic properties of the fluid element
· when describing fluid flow, to apply the laws of conservation of mass, momentum and energy
· to explain the formation of a boundary layer in a fluid
· to apply dimensional analysis to the obtained results</td></tr>
<tr><td>Syllabus</td><td colspan="3">The content is divided into the following twelve teaching units:
1. Lagrange and Euler's description of motion (2 hours of lectures and 2 hours of exercises)
2. Fluid properties (4 hours of lectures and 4 hours of exercises)
3. Fluid statics (4 hours of lectures and 4 hours of exercises)
4. Control volume (2 hours of lectures and 2 hours of exercises)
5. Laminar flow (2 hours of lectures and 2 hours of exercises)
6. Equation of continuity (2 hours of lectures and 2 hours of exercises)
7. The first law of thermodynamics for fluid (2 hours of lectures and 2 hours of exercises) 8. Viscosity (2 hours of lectures and 2 hours of exercises)
9. Motion equations for fluid (4 hours of lectures and 4 hours of exercises)
10. Turbulent flow (2 hours of lectures and 2 hours of exercises)
11. A boundary layer (2 hours of lectures and 2 hours of exercises)
12. Dimensional analysis (2 hours of lectures and 2 hours of exercises)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☑ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☑ domaće zadaće
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Writing reports on the conducted experiments. Attendance.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1.5 | Research: | Practical work:
Experimental work: | Paper: | Domaće zadaće: 0.5
Essay: | Seminar paper: |
Colloquiums: | Oral exam: 2 |
Written exam: 2 | Project: | </td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Twice during the semester, students take a written pre-exam. Students that reach more than 50% of possible points were acquitted of taking the written exam and can access the oral exam directly. Furthermore, those students that in the first written pre-exam achieve 50% points or more, can take the oral exam in two parts The final</td></tr>
</table>

	grade is based on written (pre-)exam (1/2 of the score) and the oral exam (1/2 of the score).		
Required literature	Title	Number of copies available	Availability on other medium
	Philip J. Pritchard, John W. Mitchell, Fox and McDonald's Introduction to Fluid Mechanics John Wiley & Sons, 2011.		
Supplementary literature	D. J. Acheson Elementary Fluid Dynamics Clarendon Press, 2005. Y. Nakayama & R. F. Boucher Introduction to Fluid Mechanics Butterworth, 2000.		
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Introduction to Numerical Mathematics</td></tr>
<tr><td>ID</td><td>PMM108</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Andrijana Ćurković</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30
S: 0
E: 30
P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The aim of this course is to introduce basic concepts and results in numerical analysis such as: approximation, numerical integration and differentiation, numerical solutions of linear and nonlinear equations.

Students will gain preliminary knowledge for advanced courses in numerical analysis and get insight in modern trends where numerical methods, based upon sound computational mathematics, are the basic algorithms underpinning computer predictions in modern science.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Enrolment requirements: Introduction to algebra with analytic geometry, Diferential and integral calculus I

Entry competences: matrix, differential and integral calculus.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon successful completion of this course students will be able to:

– demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems

– apply numerical methods to obtain approximate solutions to mathematical problems

– derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations

– analyse and evaluate the accuracy of common numerical methods.</td></tr>
<tr><td>Syllabus</td><td colspan="3">– Introduction: Preliminaries and error analysis (1)
– Function evaluation; Horner's scheme. Complete Horner's scheme (1)
– Solving linear systems; Gaussian elimination; LU factorization; LU factorization with pivoting (2)
– Numerical properties of Gaussian elimination; Cholesky decomposition; Iteration methods (2)
– Orthogonal polynomials and their properties (1)
– Lagrange interpolation; Newton interpolation; Hermite interpolation (3)
– Linear spline; Cubic spline (2)
– Least squares approximation; Minimax approximation (4)
– Numerical integration: Newton-Cotes formulae; Midpoint rule; Trapezoidal rule; Simpson's rule; Romberg integration (2)
– Gaussian quadrature (2)
– Rootfinding for nonlinear equations: The bisection method; The secant method; Regula falsi (2)
– Newton's method; Methods of higher order (2)
– Fixed point iteration (2)

– Numerical solutions of nonlinear systems of equations (2)

– A chosen topic (2)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attending classes. Working individually through exercises, in addition to group work during classes.</td></tr>
<tr><td>Monitoring student work</td><td>Class attendance: 2</td><td>Research:</td><td>Practical work:</td></tr>
</table>

<table>
<tr><td rowspan="4"></td><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>2</td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">Two partial written exams / one final written exam and final oral exam. Written and oral exams are equally evaluated in the final grade.</td></tr>
<tr><td rowspan="4">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">V. Hari at all, Numerička analiza, PMF, Zagreb, 2003., skripta</td><td></td><td></td></tr>
<tr><td colspan="4">M. Klaričić Bakula, Uvod u numeričku matematiku, PMFST, 2009., predavanja</td><td></td><td></td></tr>
<tr><td colspan="4">R. Scitovski, Numerička matematika, Odjel za matematiku Sveučilišta u Osijeku, 2004., skripta</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">K. Atkinson, An Introduction to Numerical Analysis, John Wiley, New York, 1989.
D. Kincaid and W. Cheney, Numerical Analysis, Brooks & Cole PC, Pacific Grove, 1990.
R. Burden & J. D. Faires, Numerical Analysis, Brooks & Cole PC, Pacific Grove, 2011.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Summary feedback for the whole class after the exam.

Anonymous student survey.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="3">Introduction to Data Analysis</td></tr>
<tr><td>ID</td><td>PMP165</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Žarko Kovač</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 20, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>0%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">– acquiring basic knowledge of measurement methods in environmental physics
– acquiring the basic skills needed to load and graphically display data
– train students to apply optimization methods for data processing and noise removal
– to train students for independent processing of time series
– to acquaint students with more advanced methods of processing time series</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">– basics of physics
– basics of mathematics
– basic programming</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">1. Introductory knowledge of measurement methods in environmental physics.
2. Knowledge of reading and graphically displaying data.
3. Knowledge of linear and nonlinear regression.
4. Knowledge and the use of optimization methods in data processing.
5. Detection of trend and seasonal signal in a time series.
6. Usage of a moving mean as a filter.
7. Introductory theoretical knowledge and application of the Fourier transform.
8. Introductory theoretical knowledge and application of empirical orthogonal functions.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Sampling and measurement methods in environmental physics (1 hour of lectures and 2 hours of exercises)
2. Normal distribution (1 hour of lectures and 2 hours of exercises)
3. Least squares method (2 hours of lectures and 4 hours of exercises)
4. Linear regression (2 hours of lectures and 4 hours of exercises)
5. Nonlinear regression (2 hours of lectures and 4 hours of exercises)
6. Trend and seasonal signal (1 hour of lectures and 2 hours of exercises)
7. Moving mean (1 hour of lectures and 2 hours of exercises)
8. Fourier transform (2 hours of lectures and 4 hours of exercises)
9. Empirical orthogonal functions (3 hours of lectures and 6 hours of exercises)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☑ domaće zadaće
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attend at least 70% of lectures and 70% of exercises.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3">Class attendance: 1.7; Research: ; Practical work: 1.3
Experimental work: ; Paper:
Essay: ; Seminar paper:
Colloquiums: ; Oral exam: 1
Written exam: ; Project: 1</td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">During the first 7 weeks of classes, students receive 5 homework assignments from the first 5 teaching units. These assignments are handed over at the end of the 8th week of classes. During the next 7 weeks of classes, students receive 5 new homework assignments from the last 4 teaching units. These assignments are handed over at the end of the 15th week of class. Students who submit assignments on time and achieve more than 50% of the possible points are exempted from writing the written part of the exam. Students who do not pass assignments or achieve less than 50% of the possible points must take a written exam. In the 8th week of classes, students are given a project assignment that they must submit by the end of the semester. The final grade is formed on the basis of homework / exam (1/3 of the grade), project assignment (1/3) and answers to the oral exam (1/3) of the grade.</td></tr>
<tr><td>Required literature</td><td colspan="2"></td><td>Number</td></tr>
</table>

	Title	of copies available	Availability on other medium
	William Menke, Joshua Menke Environmental Data Analysis with MATLAB Elsevier, 2016		
Supplementary literature	Zhihua Zhang: Environmental data analysis: Methods and applications, Walter de Gruyter, 2017. David M. Glover, William J. Jenkins, Scott C Dooney: Modelling methods for marine science, Cambridge University Press, 2011.		
Quality assurance	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="7">Introduction to Applied Mathematics</td></tr>
<tr><td>ID</td><td>PMM701</td><td>Study year</td><td colspan="4">2.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Andrijana Ćurković</td><td>Points value (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="4">40%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Demonstrate examples of real life problem that can be modeled by differential equations and / or solved by numerical methods. Explore the use of differential and integral calculus to solve ordinary differential equations and simple numerical problems.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">The student must have passed the following courses: Introduction to Mathematical Analysis, Mathematical Analysis I.

The student must have taken the following course: Mathematical Analysis II.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">After completing the course, students are expected to:

identify real-life problems that can be modeled by differential equations and/or solved using numerical methods;

distinguish the characteristic properties of linear equation from nonlinear ones;

select and apply appropriate methods to solve basic differential equations;

explain the reasons, advantages and disadvantages of using numerical methods;

apply basic numerical methods for solving nonlinear equations;

explain ideas and apply methods to solve interpolation problems</td></tr>
<tr><td>Syllabus</td><td colspan="6">Introduction: Ordinary Differential Equations, Motivation (1)

First Order Ordinary Differential Equations: Existence and Uniqueness of Solution. Different types of First Order Equations (including ODE with separable variables, homogeneous, Bernoulli, exact) (3)

Higher Order Linear Differential Equations: Homogeneous Linear Equations. Wronskian. Nonhomogeneous Equations (Undetermined Coefficients, Variation of Parameters) (3)

Approximation theory, Motivation, Error analysis (1)

Numerical methods for solving nonlinear equations: Bisection method, Newton's method, Fixed point iteration method (1)

Basic idea of interpolation, Lagrange and Newton form of interpolating polynomial, Linear and cubic spline (3)

Basic idea of numerical integration (1)

Numerical methods for differential equations: basic concept (1)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="4">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Attend class regularly and take notes. Take exams when scheduled.</td></tr>
</table>

Monitoring student work						
Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			

<table>
<tr><td rowspan="2"></td><td>Colloquiums</td><td></td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>2</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">The final exam consists of a written and an oral part. Successful written exam is required for taking the oral exam. Acceptable results achieved in midterm exams taken during the semester replace the written part of the exam.</td></tr>
<tr><td rowspan="3">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">W.E. Boyce and R.C. DiPrima, Elementary Differential Equations and Boundary Value Problems, John Wiley & Sons, Inc., New York, 2012.</td><td></td><td></td></tr>
<tr><td colspan="4">R. Scitovski, Numerička matematika, Odjel za matematiku, Sveučilište u Osijeku, 2004.</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">M. Alić, Obične diferencijalne jednadžbe, skripta, PMF, Zagreb, Matematički odjel,

1994.

V. Hari i dr, Numerička analiza, skripta PMF, Zagreb, Matematički odjel, 2004.

K. Atkinson, An Introduction to Numerical Analysis, John Wiley, New York, 1989.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Student evaluations following completion of the course. The evaluations are administered according to the regulations of the University of Split.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

Subject name	Introduction to Computing						
ID	PMIA10	Study year	1.				
Lecturer	doc. dr. sc. Jelena Nakić	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	15	30	0	
Subject status	Compulsory	Online percentage	35%				

Subject description

Subject goals	The course offers an insight to a number of other computer science courses to be thought during the study programme, addressing the computer science field as a research as well as an application field. Additionally, the course aims to introduce main mathematical fundamentals necessary for understanding basic principles of digital computer operation. The course provides acquisition of fundamental knowledge related to the history of computing, computer architecture, operating systems, database systems, computer networks, computer graphics and artificial intelligence. Labs provide achievement of basic knowledge and concepts related to numerical notation, logic circuits, text editing, spreadsheets and databases.
Enrolment requirements	No formal prerequisites.
Learning outcomes	Describe the history of computing. Define and name the main fields of computer science. Describe the fundamental terminology and concepts from computer architecture, operating systems, database systems, computer networks, architecture of Internet applications, computer graphics and artificial intelligence. Apply applications for text editing, spreadsheet programs, and database management systems for problem solving. Identify and argument limits of certain fields of computer science.
Syllabus	Lectures: Algorithms; History of computing Main principles of computer technology Numerical notation and representation of data Data storage and data compression First exam Computer architecture and simulation od logic circuits Operating systems Networking and the Internet Internet protocols and security Database systems Computer graphics Artificial intelligence Second exam Exercises: Introduction Numerical notation Logic circuits Problem solving Word processor Spreadsheets Database Problem solving
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	Active participation in all activities: lectures, lab activities, consultations; individual work in homework and the assigned project; exam

Monitoring student work						
	Class attendance	2	Research		Practical work	1
	Experimental work		Paper			

	Essay		Seminar paper	1		
	Colloquiums	1	Oral exam	0.5		
	Written exam	0.5	Project			
Assessment and evaluation of student work	Class attendance (10%) Individual project (10%) Final/Oral Exam (80%)					
Required literature	Title			Number of copies available	Availability on other medium	
	Computer Science: An Overview, Brookshear, J. Glenn Brylow, Dennis, prijevod, ISBN 9789537398514			20		
Supplementary literature	all course material is available on-line, including related articles					
Quality assurance	student discussion, anonymous student evaluation questionnaire, student success rate, self-assessment					
Other (in the opinion of the proponent)						

<table>
<tr><td>Subject name</td><td colspan="3">Introduction to Statistical Physics</td></tr>
<tr><td>ID</td><td>PMP114</td><td>Study year</td><td>1.</td></tr>
<tr><td>Lecturer</td><td>izv. prof. dr. sc. Larisa Zoranić</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td><table><tr><td>L</td><td>S</td><td>E</td><td>P</td></tr><tr><td>30</td><td>0</td><td>30</td><td>0</td></tr></table></td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>10%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Introducing students to the basic properties and description of many-particle systems through the concepts of thermodynamics and statistical physics in the thermodynamic limit, along with the acquisition of basic terms such as entropy, thermodynamic potentials, ensembles, distribution functions and probability density. A qualitative understanding of the experimentally observed phenomena of microscopic physical models and the ability to quantitatively describe and solve problems using the appropriate mathematical formalism are expected.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Passed courses in General Physics I, II and Mathematics and completed courses in General Physics III and IV and Classical Mechanics.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After successfully completing the course, the student will be able to:
1. Explain the foundations of statistical physics (Brownian motion, multiparticle system, thermalization, postulate of equal probabilities).
2. Derive the Boltzmann distribution, discuss the properties of this distribution, and apply it to interpret the equipartition theorem.
3. Formulate ensemble theory.
4. Describe macroscopic systems within the framework of microcanonical and canonical ensembles and derive their thermodynamic quantities.
5. Compare the classical and quantum statistical description of the system and discuss the limits of their applicability.
6. Derive and apply the Fermi-Dirac and Bose-Einstein distributions, discuss the applicability conditions, and the behavior in classical limes.
7. Identify and describe the statistical nature of concepts and laws in thermodynamics, especially: entropy, temperature, chemical potential, thermodynamic potentials and partition function.
8. Compare the classical and quantum description of an ideal gas and a linear harmonic oscillator.
9. Formulate and apply the blackbody radiation model and the crystal lattice oscillation model.
10. Describe and analyze a highly degenerate electron gas.</td></tr>
<tr><td>Syllabus</td><td colspan="3">The timetable worked out according to the weekly plan:
1. Introduction to the course. Thermodynamics. Basic concepts of statistics and probability theory. Statistical behavior of many-particle systems. Maxwell's distribution. Brownian motion. Thermalization.
2. Statistical ensembles. Balance. Density function and probability density. Phase space. Average values of physical quantities and partition function.
3. Microcanonical ensemble. Entropy. System stability conditions.
4. Canonical ensemble. The most probable distribution. Boltzmann distribution. Lagrange multipliers.
5. Ideal gas in the canonical ensemble. Comparison of microcanonical and canonical ensemble. Free energy.
6. Explanation of the second law of thermodynamics. Thermal properties of an ideal gas. The law of equal energy distribution.
7. Classical harmonic oscillator.
8. Heat capacity of crystal lattice, ideal gas and two-state model.
9. Quantization of energy levels. Identical particles. Symmetry of wave functions.
10. Explanation of the third law of thermodynamics. Limits of classical statistics.
11. Quantum harmonic oscillator.
12. Black body radiation: Planck distribution. Rayleigh-Jeans formula, Stefan-Boltzmann law, Wien's law. Photons.
13. Vibration of atoms in crystals: Einstein's and Debye's model. Phonons.
14. Bose-Einstein and Fermi-Dirac distributions.
15. Function density of state. Highly degenerate fermionic system.</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars</td><td>☐ Fieldwork
☑ Individual assignments</td><td>☐</td></tr>
</table>

	☑ Exercises ☐ Fully online ☐ Combined online	☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐

Student obligations	Attendance and commitment of students in class, solving tasks in class and at home. Participation in class discussions and debates.

Monitoring student work						
	Class attendance	2	Research		Practical work	
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums	1	Oral exam	2		
	Written exam		Project			

Assessment and evaluation of student work	Knowledge is tested by a written and oral exam. Colloquiums are organized during classes. Students who do not pass the written part through the colloquium have 4 additional exam deadlines for passing the written part. The oral exam is taken after the written part.

Required literature	Title	Number of copies available	Availability on other medium
	Statistical mechanics-3rd ed. R. K. Pathria, Paul D. Beale, 2011 Elsevier Ltd.		online
	Concepts in thermal physics, S. Blundell and K. M. Blundell, 2006 Oxford University Press		online
	Statistical physics, Z. Glumac, online script		online

Supplementary literature	Elementary Statistical Physics, C. Kittel, Dover Publications, 2004 Introduction to Statistical Physics, Kerson Huang, Taylor and Francis, 2001. K. Dill and S. Bromberg, Molecular Driving Forces: Statistical Thermodynamics in Biology, Chemistry, Physics, and Nanoscience, Garland Science; 2nd edition (2010) Feynman, The Feynman Lectures on Physics, (Chapters 39-46), 1963. Scientific articles, lectures
Quality assurance	The success of the program is monitored by the quality of knowledge demonstrated in the exams as well as by assessing the enthusiasm shown for the subject. External evaluation includes student surveys. Statistics of exam results and student evaluation through an anonymous survey on at the end of the course performance. The survey is conducted according to the rules of the University of Split.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="3">Introduction to Number Theory</td></tr>
<tr><td>ID</td><td>PMM102</td><td>Study year</td><td>2.</td></tr>
<tr><td>Lecturer</td><td>prof. dr. sc. Borka Jadrijević</td><td>Points value (ECTS)</td><td>5.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30, S: 0, E: 30, P: 0</td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">Students will acquire basic knowledge in elementary number theory and the ability to apply that knowledge in solving various problems related to these topics. The course is a good background for understanding and learning more advanced courses in this area.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">None</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">Upon successful completion of the course, the student is able to: – define and interpret the fundamental concepts of divisibility and apply them to solve a variety of problems; – formulate and prove basic results of modular arithmetic; – perform calculations using modular arithmetic; – solve congruences and system of congruences of various types; – prove basic results about quadratic residues and use the Quadratic Reciprocity Law to calculate the Legendre symbols; – describe important multiplicative functions in number theory; – formulate basic concepts of binary quadratic forms; – describe and use formulas for generating the Pythagorean triples; – define continued fraction expansion, compute continued fraction expansion for rationals and quadratic irrationals and apply it to solving the Pell equation.</td></tr>
<tr><td>Syllabus</td><td colspan="3">1. Divisibility. Greatest common divisor. Euclidean algorithm. Linear Diophantine equations. Primes. Unique factorization. (3 hours)
2. Congruences. Linear congruences. Chinese remainder theorem. Euler's theorem. Wilson's theorem. Hensel's lemma. Primitive roots and indices. (9 hours)
3. Quadratic residues. Legendre symbol. Quadratic reciprocity law. Jacobi symbol. (4 hours)
4. Quadratic forms. Equivalence and reduction of binary quadratic forms. Sums of two and four squares. (3 hours)
5. Arithmetic functions. Number and sum of positive divisors functions. Euler and Möbius functions, Distribution of primes. Asymptotic estimates for arithmetic functions. (4 hours)
6. Diophantine approximation and Diophantine equations. Dirichlet's theorem. Continued fractions. Diophantine approximation. Pell equation. Pythagorean triples. (7 hours)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td>☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="3">Attendance of lectures and tutorial sessions is obligatory.</td></tr>
<tr><td>Monitoring student work</td><td colspan="3"><table>
<tr><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2.5</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>1.5</td><td>Project</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">The exam is taken in written and oral form. The passing grade of the written exam is a requirement for the oral exam. Both parts of the exam are equally weighted in the final grade. There are two partial written exams during the semester. Passing both partial written exams allows students to take the oral exam. In case of failure of the partial exams or the oral exam, the student must retake the written exam before taking the oral exam again.</td></tr>
<tr><td>Required literature</td><td colspan="3"><table>
<tr><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td></tr>
</table>

	A.Dujella, Uvod u teoriju brojeva, skripta PMF-MO, Zagreb http://web.math.hr/~duje/utb.html;		
	I. Niven,H. S. Zuckerman, H. L. Montgomery, An Introduction to the Theory Numbers, Wiley, New York, 1991;		
	K. H. Rosen, Elementary Number Theory and Its Applications, Addison-Wesley, Reading, 1993.;		
	M. Bombardelli, A. Dujella, S.Slijepčević, Matematička natjecanja učenika srednjih škola, HMD, Element, Zagreb, 1996;		
Supplementary literature	H. A. Baker: A Concise Introduction to the Theory of Numbers, Cambridge University Press, Cambridge, 1994. H. E. Rose, A Course in Number Theory, Oxford University Press, Oxford, 1995;		
Quality assurance	Statistics of test results and anonymous student evaluations at the end of the semester according to the regulations of the University of Split.		
Other (in the opinion of the proponent)			

<table>
<tr><td>Subject name</td><td colspan="3">Introduction to topology</td></tr>
<tr><td>ID</td><td>PMM114</td><td>Study year</td><td>3.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Goran Erceg</td><td>Points value (ECTS)</td><td>6.0</td></tr>
<tr><td>Associates</td><td></td><td>Class execution (number of hours in semester)</td><td>L: 30 | S: 0 | E: 30 | P: 0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td>30%</td></tr>
<tr><td colspan="4">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="3">The course objective is to introduce students with fundamental concepts and methods in general topology. This gives the basics for more advanced studies in analysis, topolgy and geometry as well as courses building on these topics.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="3">Successfully completed course: Set theory</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">It is expected that a student will

– understand fundamental concepts and methods in general topology

– be able to state and prove standard results regarding (compact, connected) topological spaces and continuous functions

– be able to apply the theory in the course to reason about concrete topological spaces and their properties

– be able to decide whether a simple statement about topological spaces and continuous functions is true, providing a proof or counterexample as appropriate

– develop critical and analytical thinking and demonstrate skills in communicating mathematics orally and in writing</td></tr>
<tr><td>Syllabus</td><td colspan="3">– Basic notions (6 hours)

Topological space. Basis and subbasis. The second countable space. Metric topology. Closed sets. Interior, closure and boundary of a set. Neighbourhoods. Local base. The first countable space. Derived set. Density. Separability. Subspace. Product space. Quotient space.

– Separation axioms (2 hours)

T1-spaces. Hausdorff spaces. Regular spaces. Normal spaces.

– Convergence (6 hours)

Limit of a sequence. Accumulation point of a sequence. Pointwise and uniform convergence. Convergence of nets.

– Continuity (6 hours)

Continuous functions. Characterization of continuous functions. Homeomorphism. Embedding. Urysohn characterization of normal spaces. Tietze extension theorem.

– Connectedness (6 hours)

Connected space. Characterization of connected spaces. Pathwise connected space. Components and path-components. Product of (pathwise) connected spaces. Locally (pathwise) connected space.

– Compactness (6 hours)

Compact space. Characterization of compact spaces. Compact metric spaces. Product of compact spaces. Continuous functions on compact spaces. Dini's theorem. Locally compact space. Compactification</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises</td><td>☐ Fieldwork
☐ Individual assignments
☐ Multimedia</td><td>☐
☐</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">☐ Fully online
☐ Combined online</td><td colspan="2">☐ Laboratory
☐ Mentoring</td><td>☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="5">Attendance at lectures and exercises, written assignments, self-study using required and optional literature</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Ispit</td><td>5.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">The exam consists of written and oral part. The oral part comes after positively graded (at least 50%) written part Both parts of the exam are equally evaluated in the final grade.</td></tr>
<tr><td rowspan="4">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">J. Munkres, Topology, Pearson Education International, New York, 2000</td><td></td><td>da</td></tr>
<tr><td colspan="4">S. Mardešić, Matematička analiza u n-dimenzionalnom realnom prostoru I, Školska knjiga, Zagreb, 1974.</td><td></td><td></td></tr>
<tr><td colspan="4">J. Dugundji, Topology, Allyn and Bacon Inc. Boston, 1966</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">R. Engelking, General Topology, PNW, Warszawa, 1977.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Exam statistics and students' quality evaluation through anonymous poles</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

Subject name	Introduction to Artificial Intelligence		
ID	PMII10	Study year	1.
Lecturer	prof. dr. sc. Saša Mladenović	Points value (ECTS)	5.0
Associates		Class execution (number of hours in semester)	L: 30, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	25%

Subject description	
Subject goals	Artificial Intelligence (AI) is devoted to the computational study of intelligent behavior. The element that the fields of AI have in common is the creation of agents/machines that can "think". This course will cover a broad introduction to the techniques that enable agents/computers to behave intelligently: problem solving, representing knowledge, reasoning, learning, perceiving, and interpreting. The bulk of this course reflects this diversity. We will examine the fundamental questions and issues of AI and will explore the essential techniques. The course is project oriented, with programming assignments spread throughout the semester using the LISP based NetLogo programming environment and Prolog programming language.
Enrolment requirements	None.
Learning outcomes	Upon successful completion of this course, the student will be able to: 1. To understand the modern view of AI as the study of agents that receive percepts from the environment and perform actions 2. Describe the major applications, topics, and research areas of artificial intelligence (AI), including search, machine learning, knowledge representation and inference, natural language processing, vision, and robotics. 3. Apply basic techniques of AI in computational solutions to problems. 4. Discuss the role of AI research areas in growing the understanding of human intelligence. 5. Identify the boundaries of the capabilities of current AI systems.
Syllabus	1. Introduction to concept of intelligence (2h) 2. Multiple types of intelligence (2h) 3. Intelligent Agents and environments (2h) 4. Problem Solving by Search (2h) 5. Uninformed Search algorithms (4h) 6. Informed Search algorithms (2h) 7. Midterm 8. Artificial Neural Networks (2h) 9. Multiagent systems (2h) 10. Knowledge representation (2h) 11. Genetic algorithms (2h) 12. Special Topics: Learning, Robots in education (2h) 13. Practical examples of artificial intelligence usage (2h) 14. Artificial intelligence and ethical problems (2h) 15. Project (2h) Laboratory exercises match lecture topics and schedule.
Teaching types	☑ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☑ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☑ Laboratory ☐ Mentoring
Student obligations	Lecture and laboratory attendance, active participation in course activities, homework and project realization, final exam.

Monitoring student work						
	Class attendance	1	Research	0.5	Practical work	1
	Experimental work		Paper			
	Essay		Seminar paper			
	Colloquiums	0.5	Oral exam	0.5		
	Written exam	0.5	Project	1		

Assessment and evaluation of student work	Attendance/Participation (20%) Midterm / Project (40%) Final/Oral Exam (40%)

Required literature	Title	Number of copies available	Availability on other medium
	Artificial Intelligence: A Modern Approach. Stuart Russell and Peter Norvig Prentice Hall, 2009 ISBN:0136042597 9780136042594		
	Lecture notes: Uvod u umjetnu inteligenciju, Saša Mladenović, Goran Zaharija		
Supplementary literature	Online Student material, including solutions to selected problems and additional reading		
Quality assurance	Student discussion, anonymous student evaluation questionnaire, student success rate, self-assessment		
Other (in the opinion of the proponent)			

Subject name	INTRODUCTION OF PROBABILITY		
ID	PMM716	Study year	1.
Lecturer	doc. dr. sc. Snježana Braić	Points value (ECTS)	8.0
Associates		Class execution (number of hours in semester)	L: 45, S: 0, E: 45, P: 0
Subject status	Compulsory	Online percentage	30%
Subject description			
Subject goals	Main course objective is to get students acquainted with basic ideas, results and methods of probability theory and mathematical statistics. Students will: be introduced to concepts of probability space and analyse its properties learn basic examples of probability spaces acquire basic knowledges about conditional probability and analyse its properties acquire basic knowledges about random variables and their probability density and distribution functions learn Chebyshev inequality, law of large numbers and central limit theorem learn to compute numerical characteristics of random variables be introduced with the basics of mathematical statistics		
Enrolment requirements	Course enrolment: successfully completed course Differential and integral calculus I successfully completed course Combinatorics taken courses Mathematical analysis in Rn I and II, or Differential and integral calculus II		
Learning outcomes	Upon successful completion of this course students will be able to: define probability space and describe its properties describe basic examples of probability spaces distinguish and describe probability models define conditional probability and analyse its properties apply probability properties and combinatorial methods in solving probability problems define discrete and continuous random variables and their probability density and distribution functions define, compute and analyse numerical characteristics of discrete random variables state, prove and apply theorems of probability theory define random sample and statistics, describe estimators and calculate confidence intervals		
Syllabus	Sample space, probability space (3) Discrete probability space– definition and properties (3) Conditional probability, independent events (4) Bernoulli trials (2)		

	Discrete random variables and their distribution (3) Density function and distribution function of discrete random variable (3) Numerical characteristics of discrete random variables (6) Chebyshev inequality, law of large numbers and central limit theorem (3) Random vectors, probability generating functions (4) Measure spaces (2) Continuous random variables, density function and distribution function (4) Mathematical expectation and variance of continuous random variables (3) Random sample, statistics, estimators and confidence intervals (5) Matematičko očekivanje i varijanca neprekidnih slučajnih varijabli (3) Slučajni uzorci, statistike, procjenitelji, pouzdani intervali (5)
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Attendance.

Monitoring student work					
Class attendance	2	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	3	Oral exam	3		
Written exam		Project			

Assessment and evaluation of student work	The exam which requires solving practical and theoretical problems is taken in written form and is followed by an oral theoretical exam. A passed written exam is a prerequisite for the oral exam. The written exam can be taken partially, in three parts, during class.

Required literature

Title	Number of copies available	Availability on other medium
S. Braić, V. Gotovac, I. Ugrina, Uvod u vjerojatnost i statistiku, skripta PMF-a u Splitu		
N. Sarapa, Teorija vjerojatnosti, Školska knjiga, Zagreb, 2002..		
N. Sarapa, Vjerojatnost i statistika I i II, Školska knjiga, Zagreb, 1993..		

Supplementary literature	1. W. Feller, An Introduction to Probability Theory and Its Application, J.Wiley, New York, 1966. 2. I. Sošić, Primijenjena statistika, Školska knjiga, Zagreb, 2004. 3. T. Pogany, Teorija vjerojatnosti, zbirka riješenih ispitnih zadataka, Sveučilište u Rijeci, Odjel za pomorstvo, Rijeka, 1999. 4. M. Spiegel, J. Schiller, R. A. Srinivasan, Probability and Statistics, Schaum's outline series, McGraw-Hill Book Company, New York, 2000.
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.

Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="6">Introduction to the scientific work</td></tr>
<tr><td>ID</td><td>PPC214</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Viljemka Bučević Popović</td><td>Points value (ECTS)</td><td colspan="4">2.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>15</td><td>15</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">33%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Course objective is to introduce students to the methodology of the scientific work, searching the scientific literature, and writing the scientific articles.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">None.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">Upon completion of the exam, students will be able to:
1. performe the literature search
2. critically evaluate scientific articles
3. plan the writing of scientific articles
4. apply methodology of scientific work</td></tr>
<tr><td>Syllabus</td><td colspan="6">Lectures followed by seminars will be conducted on the following topics:
1. Science (history, role and characteristics of science) (2 hours lecture).
2. Scientific research (scientific way of thinking, scientific work, ethics in science) (2 hours of lecture, 1 hour of seminar)
3. Types of research, research planning (2 hours lecture, 1 hour seminar)
4. Collecting data, processing and presenting data (1 hour lecture and 2 hours seminar)
5. Literature search (1 hour lecture and 3 hours seminar)
6. Scientific publications (1 hour lecture, 1 hour seminar)
7. Writing scientific articles (1 hour lecture and 2 hours seminar)
A part of the class related to internet resources will be organized as e-learning (30%).</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☑ Seminars
☐ Exercises
☐ Fully online
☑ Combined online</td><td>☐ Fieldwork
☑ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="4">☐
☐
☐
☐</td></tr>
<tr><td>Student obligations</td><td colspan="6">Attending classes (Skipping 20 % lectures is allowed). Students must prepare and present seminar work</td></tr>
</table>

<table>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>0.7</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td>Priprema za ispit</td><td>0.7</td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td></td><td></td><td></td></tr>
<tr><td>Written exam</td><td>0.1</td><td>Project</td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><td>Assessment and evaluation of student work</td><td colspan="3">Passing grade on the written exams is set at 50 % of total points. Written part of the exam comprises 50 % of overall grade seminar comprises another 50 %.</td></tr>
<tr><td rowspan="2">Required literature</td><td>Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td>Matko Marušić i suradnici, Uvod u znanstveni rad u medicini, Medicinska naklada - Zagreb, 5 izdanje, 2013,</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="3">Selected scientific articles</td></tr>
<tr><td>Quality assurance</td><td colspan="3">Personal consultations, completing partial exams, students survey for the evaluation of the subject and teacher, evidence of the presence on the classes, analysis of the success rate on the final tests.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="3"></td></tr>
</table>

Subject name	Waves and Optics						
ID	PMP006	Study year	2.				
Lecturer	doc. dr. sc. Toni Šćulac	Points value (ECTS)	9.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			60	15	30	0	
Subject status	Compulsory	Online percentage	0%				

Subject description	
Subject goals	Allow understanding and application of physics terms and laws of oscillations, waves, and optics with the goal of solving problems, explening natural phenomena and how different instruments work.
Enrolment requirements	Mehanics (passed)
Learning outcomes	1. Derive and use equation for mechanical and electromagnetic oscilatory systems that transfer energy, discuss the limits of the equation its starting conditions and boundry conditions 2. Define and anlyse normal modes of oscillations for two or more systems that are connected 3. Derive and use the wave equation for different mechanical and electromagnetic systems, discuss the limits of the equation its starting conditions and boundry conditions 4. Analyse and explain superposition of two or more wave sources, difraction, and interference and conditions needed for them to occure 5. Analyse wave propagation in different media, discuss dispersion nad group and phase velocity of waves 6. Discuss and use concepts and laws of geometrical optic to describe and explain optical instruments, their usage and limitations 7. Discuss main experiments of the wave nature of light 8. Critically discuss application of the laws of oscillations, waves, and optics in eveyday life 9. Use analitical and numerical methods to solve problems for mechanical and electromagnetic oscillations, waves, and optics
Syllabus	1. OScillations. Simple harmonic oscillator. Damping. Forced oscillations. (4 + 1 + 2 hours) 2. Addition of harmonic oscillators. (4 + 1 + 2 hours) 3. Transversal and longitudinal waves. Wave equation. (4 + 1 + 2 hours) 4. Velocity of transversal waves. Energy and power of the wave. Wave packet.(4 + 1 + 2 hours) 5. Interferention. Standing waves. Reflection. Standing waves. Resonance. (4 + 1 + 2 hours) 6. Fourier analysis. (4 + 1 + 2 hours) 7. Sound waves. Doppler effect. (4 + 1 + 2 hours) 8. Waves in solid state medium. (4 + 1 + 2 hours) 9. Electromagnetic oscillations. (4 + 1 + 2 hours) 10. Polarisation and dispersion. (4 + 1 + 2 hours) 11. Optics, mirrors, and lenses. (4 + 1 + 2 hours) 12. Wave optics. Interferention. Difraction. (4 + 1 + 2 hours) 13. Optical instruments (4 + 1 + 2 hours) 14. Spectral analysis. Lasers. (4 + 1 + 2 hours) 15. Dual properties of particles and waves. (4 + 1 + 2 hours)
Teaching types	☑ Lectures ☑ Seminars ☑ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	1. Active participation during classes with critical judgment and argumented opinion, questions, and answers to questions 2. Solving given problems 3. Critical discussions

Monitoring student work						
	Class attendance	3.5	Research		Practical work	
	Experimental work		Paper		Problem solving	1
	Essay		Seminar paper			

	Colloquiums		Oral exam	2.5		
	Written exam	2	Project			

Assessment and evaluation of student work	Solutions of problems from exercises will be graded together with the oral exam.		
Required literature	Title	Number of copies available	Availability on other medium
	Halliday, Resnick, Walker: Fundamentals of Physics, John Wiley & Sons, 2003.	6	yes
	Mile Dželalija, slides from lectures, 2015.		yes (free access)
Supplementary literature	– F.S. Crawford. Waves. Berkeley Physics Course III, McGraww-Hill, New York – Babić, R. Krsnik i M. Očko, Zbirka riješenih zadataka iz fizike. Školska knjiga, Zagreb 1982. – F.W. Sears, M.W. Zemansky, H. D.Young, R. A. Freedman. University Physics. Addison Wesley London, 2000. – R.P. Feynman, R.B. Leighton, M. Sands. The Feynman lectures on physics I, Addison-Wesley, London 1975. – M. Paić, Osnove fizike I,IV, Liber, Zagreb, 1978-1983.		
Quality assurance	1. Lecturers who have subjects with correlated learning outcomes work together to ensure quality of learning. 2. Statistics of test scores and assessment of performance in accordance with established learning outcomes. 3. Evaluation of students through an anonymous survey conducted in accordance with the regulations of the University of Split.		
Other (in the opinion of the proponent)			

Subject name	Vector spaces I						
ID	PMM201	Study year	1.				
Lecturer	doc. dr. sc. Gordan Radobolja	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			30	0	30	0	
Subject status	Compulsory	Online percentage	30%				
Subject description							
Subject goals	Deepen knowledge on vector spaces and linear operators Introduce Jordan form Define operator functions Introduce inner product spaces and typical operators on them						
Enrolment requirements	Courses passed: Introduction to algebra with analytic geometry, Linear algebra						
Learning outcomes	Students will be able to: analyze finite and infinite dimensional vector spaces and their properties, including the basis structure of vector spaces; give examples of fundamental notions and constructions in three dimensional Euclidean space; use the definition and properties of linear transformations and matrices of linear transformations and change of basis, including kernel, range and isomorphism; compute with the characteristic and minimal polynomial, eigenvalues and eigenspaces, find the geometric and algebraic multiplicities of an eigenvalue use methods from complex analysis in defining and calculate with operator function; compute inner products and determine orthogonality on vector spaces, including Gram-Schmidt orthogonalization.						
Syllabus	Finite dimensional vector spaces (4) Linear operators and their matrices (4) Dual space and dual operator (2) Algebras and homomorphisms (1) Minimal polynomial and spectrum (2) Invariant subspaces (1) Nilpotent operators (2) Jordan normal form of a linear operator (2) Convergence in an operator spaces (1) Operator functions (4) Inner product spaces and norm (4) Operators on inner product spaces (3)						
Teaching types	☑ Lectures ☐ Seminars ☑ Exercises ☐ Fully online ☑ Combined online	☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring	☐ ☐ ☐ ☐				

<table>
<tr><td>Student obligations</td><td colspan="6">Student responsibilities

Lectures and exercises attendances are obligatory.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td>3</td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">– 4 tests (10 pts each)
– 2 partial exams (25 pts each)
– final exam (10 pts)

Marks distribution
60 – 70 (2)
71 – 80 (3)
81 – 90 (4)
91 – 100 (5)</td></tr>
<tr><td rowspan="4">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">H. Kraljević, Vektorski prostori, skripta, Sveučilište u Osijeku, 2008.</td><td></td><td></td></tr>
<tr><td colspan="4">S. Kurepa, Konačno dimenzionalni vektorski prostori i primjene, Liber, Zagreb, 1992.</td><td></td><td></td></tr>
<tr><td colspan="4">J. S. Golan, The Linear Algebra a Beginning Graduate Student Ought to Know, Kluwer, 2004.</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">P. R. Halmos, Finite Dimensional Vector Spaces, Van Nostrand, New York, 1958.

S. Lang, Linear algebra, Addiseon-Wesley, Reading, 1973.

K. Horvatić, Linearna algebra, PMF – Matematički odjel, HMD, Zagreb, 1995.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Discussion in classes and official student survey.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

Subject name	Vector spaces II						
ID	PMM603	Study year	1.				
Lecturer	doc. dr. sc. Gordan Radobolja	Points value (ECTS)	6.0				
Associates		Class execution (number of hours in semester)	L	S	E	P	
			45	0	0	0	
Subject status	Compulsory	Online percentage	30%				

Subject description	
Subject goals	The aim of the course is to acquaint students with various concepts of the theory of vector spaces. The emphasis is on the construction of a variety of mathematical structures using bilinear forms and tensor products. Also, tensor products will be used to construct algebras and bilinear forms will be associated with groups.
Enrolment requirements	Requirements: Course passed: Vector Spaces I. Required competences: basic knowledge of mathematical structures.
Learning outcomes	Student is able to: –define bilinear and quadratic forms –explain different tensor products –apply tensor products on construction of algebras –analyse set of all invertible linear operators that preserve given bilinear, hermitian or quadratic form
Syllabus	–Dual vector space (2) –Bilinear forms (2) –Symmetric forms (2) – Quadratic forms (2) –Alternating i skew-symetric forms (2) –Hermitian forms (2) –Tensor product (3) –Symmetric product (2) –Exterior product (2) –Basic properties of algebras (2) –Tensor algebra (2) –Symmetric algebra (2) –Exterior algebra (2) – Clifford algebras (2) –Lie algebras (2) –Nonassociative algebras (2) –Linear groups (2) –General linear group (2) –Symplectic groups (2) –Unitary groups (2) –Orthogonal groups (2) –Matrix Lie groups (2)
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☐ Individual assignments ☐ Multimedia ☐ Laboratory ☐ Mentoring
Student obligations	Attending classes and writing seminar paper

Monitoring student work

Class attendance	1.5	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	3.5		
Colloquiums		Oral exam	1		
Written exam		Project			

Assessment and evaluation of student work	Students present seminars and solve practical problems during semester. Grade is decided after the final exam which can be written or oral.

Required literature

Title	Number of copies available	Availability on other medium
–		

Supplementary literature	1.M.Artin, Algebra, Prentice Hall,1991.

	2. S. Lang, Algebra, Springer,2002. 3.P.A.Grillet, Abstract algebra, Springer,2007. 4.A.W.Knapp, Basic algebra, Cornerstones, 2006. 5.S. Kurepa, Konačno dimenzionalni vektorski prostori i primjene, Liber, Zagreb, 1992. 6.K. Horvatić, Linearna algebra, skripta, Zagreb, 1992
Quality assurance	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split
Other (in the opinion of the proponent)	

Subject name	Advanced Laboratory Course in Biochemistry		
ID	PMC204	Study year	1.
Lecturer	doc. dr. sc. Viljemka Bučević Popović izv. prof. dr. sc. Matilda Šprung	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 0, S: 0, E: 30, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description	
Subject goals	Getting acquainted with the instruments and methods used in modern biochemical laboratories
Enrolment requirements	There are no prerequisites for enrolment. Entry competencies needed for following the course: 1. knowledge of the basics of practical work in the biochemistry laboratory 2. knowledge of chemical properties of biomolecules 3. understanding fundamental biochemical processes in living cells
Learning outcomes	After completing the exam, the student will be able to: 1.Perform experiments and operate instruments used in modern biochemical laboratories 2.Compare different techniques for determining the concentration and purification of biological macromolecules 3.Perform protein purification from a given biological sample and analyze it using electrophoretic techniques 4.Determine concentration of biological macromolecules 5.Perform protein-ligand binding experiments and data analysis 6.Present and interpret the results obtained in biochemical laboratory
Syllabus	EXERCISES: 1. Heterologous expression of protein in E. coli. Growth media preparation, bacteria culture preparation, induction of protein expression. Cell biomass harvest. (4 hours) 2. Bacterial cell lysis, preparation of cell protein extracts. Purification of protein by chromatography on an FPLC apparatus. (4 hours) 3. Analysis of proteins by electrophoresis (SDS-PAGE). (4 hours) 4. Determination of concentration of biological macromolecules. (4 hours) 5. Monitoring denaturation of biological macromolecules. (4 hours) 6. Assessment of protein-ligand binding and determination of binding affinities by microscale thermophoresis method (5 hours) 7. Exploring protein interactors in the cell lysates (5 hours)
Teaching types	[ ] Lectures [ ] Seminars [ ] Exercises [ ] Fully online [ ] Combined online [ ] Fieldwork [ ] Individual assignments [ ] Multimedia [x] Laboratory [ ] Mentoring
Student obligations	Attending classes, entry quizzes, final exam.

Monitoring student work

Class attendance	1	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper			
Colloquiums	0.25	Oral exam			
Written exam	0.75	Project			

Assessment and evaluation of student work	Quizzes - 20% Final exam - 80%

Required literature

Title	Number of copies available	Availability on other medium
Advanced Biochemistry Practical (laboratory manual)		

Supplementary literature	Price, Nairn: Exploring proteins: a student's guide to experimental skills and methods, Oxford University Press, 2009.

	Wilson, Walker: Priciples and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, 2010. Janson, Jan-Christer: Protein purification, Wiley, 2011. Boyer, Rodney: Modern experimental biochemistry, Addison, Wesley, Longman, Inc. 2000.
Quality assurance	The quality of teaching will be monitored by collecting feedback from students through personal consultations, joint conversations and anonymous student surveys. The students' performance in the final exam will be analyzed and used to improve the teaching performance in the next academic year.
Other (in the opinion of the proponent)	

<table>
<tr><td>Subject name</td><td colspan="7">Probability I</td></tr>
<tr><td>ID</td><td>PMM228</td><td>Study year</td><td colspan="5">1.</td></tr>
<tr><td>Lecturer</td><td>doc. dr. sc. Vesna Gotovac Đogaš</td><td>Points value (ECTS)</td><td colspan="5">6.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td><td></td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td><td></td></tr>
<tr><td>Subject status</td><td>Compulsory</td><td>Online percentage</td><td colspan="5">30%</td></tr>
<tr><td colspan="8">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="7">Course objective is stating and proving main results from classical probability theory using measure theory.</td></tr>
<tr><td>Enrolment requirements</td><td colspan="7">Course enrolment requirement: Completed course Introduction to probability and statistic. Course taken: Measure and integral

Entry competences required: Basic knowledge of measure theory and Lebesgue integration.</td></tr>
<tr><td>Learning outcomes</td><td colspan="7">At the end of this course, students should be able to:

Understand and apply probability theory concepts and methods

Use multidimensional distributions and analyze their properties

Solve problems regarding sums and sequences of random variables using characteristic functions

Differentiate between different types of convergence of random variables

Recognize conditions for applying laws of large numbers and central limit theorems</td></tr>
<tr><td>Syllabus</td><td colspan="7">Random variables. (2)

Cumulative distribution function of random variables. Classification of random variables. (2)

Cumulative distribution function of random vectors. Classification of random vectors. (2)

Probability on infinite dimensional spaces. (2)

Mathematical expectation as Lebesgue integral. Properties of mathematical expectation. Radon-Nikodym theorem (without proof). Transformation of mathematical expectation. Variance. Important inequalities. L^p spaces. (2)

Types of convergence of random variables. (2)

Integration on product spaces. (2)

Independent random variables - different characterizations. Functions of random variables and random vectors. Applications in statistics. (4)

Weak law of large numbers (2)

Strong law of large numbers. (2)

Characteristic functions (2-4)

Central limit theorem (2-4)</td></tr>
<tr><td>Teaching types</td><td>☑ Lectures
☐ Seminars
☑ Exercises
☐ Fully online
☐ Combined online</td><td colspan="2">☐ Fieldwork
☐ Individual assignments
☐ Multimedia
☐ Laboratory
☐ Mentoring</td><td colspan="4">☐
☐
☐
☐</td></tr>
</table>

<table>
<tr><td>Student obligations</td><td colspan="6">Students are obliged to regularly attend lectures and exercises.</td></tr>
<tr><td rowspan="5">Monitoring student work</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical work</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Paper</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar paper</td><td></td><td></td><td></td></tr>
<tr><td>Colloquiums</td><td></td><td>Oral exam</td><td>2</td><td></td><td></td></tr>
<tr><td>Written exam</td><td>2</td><td>Project</td><td></td><td></td><td></td></tr>
<tr><td>Assessment and evaluation of student work</td><td colspan="6">There are 2 mid-term exams during a semester. Passing both mid-term exams enables students to take an oral exam. Successfully passing the oral exam leads to successful completion of the course. Final grade is derived as the arithmetic mean of scores in mid-term exams (or a written exam) and the oral exam. In the case of failure in mid-term exams or the oral exam students must undergo a written exam before approaching oral exam again.</td></tr>
<tr><td rowspan="2">Required literature</td><td colspan="4">Title</td><td>Number of copies available</td><td>Availability on other medium</td></tr>
<tr><td colspan="4">N. Sarapa, Teorija vjerojatnosti, Školska knjiga, Zagreb, 2002.</td><td></td><td></td></tr>
<tr><td>Supplementary literature</td><td colspan="6">R. B. Ash, Real Analysis and Probability, Academic Press, New York, 1972.

M. M. Rao, Probability Theory with Applications, Academic Press, New York, 1984.

R. Durret, Probability: Theory and Examples, Wads</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Detailed statistics of student results, gathering feedback from students through official questionnaires and lecturer’s self-evaluation.</td></tr>
<tr><td>Other (in the opinion of the proponent)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Subject name</td><td colspan="6">ASSESSMENT IN EDUCATION</td></tr>
<tr><td>ID</td><td>PMM809</td><td>Study year</td><td colspan="4">1.</td></tr>
<tr><td>Lecturer</td><td>Željka Zorić, v. pred.</td><td>Points value (ECTS)</td><td colspan="4">3.0</td></tr>
<tr><td rowspan="2">Associates</td><td rowspan="2"></td><td rowspan="2">Class execution (number of hours in semester)</td><td>L</td><td>S</td><td>E</td><td>P</td></tr>
<tr><td>0</td><td>30</td><td>0</td><td>0</td></tr>
<tr><td>Subject status</td><td>Elective</td><td>Online percentage</td><td colspan="4">0%</td></tr>
<tr><td colspan="7">Subject description</td></tr>
<tr><td>Subject goals</td><td colspan="6">Enable students to systematically and effectively evaluate pupils in math education

Enable students for the evaluation of their own performance

Enable students to objectively and critically interpret results obtained through various models of evaluation of pupils' achievements in maths</td></tr>
<tr><td>Enrolment requirements</td><td colspan="6">No prerequisites for the course.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">After completing the course, the students should be able to do the following:

Set clear mathematics learning goals in accordance with the official curriculum and taxonomy standards

Distinguish between the types of assessment in education

Define objective criteria of assessment and evaluation of learning outcomes

Apply various corresponding approaches and methods of learning results assessment and explain the reasoning behind

Independently design and assess written and oral tests in accordance with the criteria set in advance

Document pupil's participation and contribution in various learning activities of math related contents

Provide concrete and effective feedback to pupils and parents on pupil's performance, progress and achieved success

Assess the learning results by assessment of results of pupils' performance

Analyse results obtained by assessment in order to increase the quality of learning and teaching a</td></tr>
<tr><td>Syllabus</td><td colspan="6">Objectives of math education and outcomes of math learning. Math concepts and processes. Knowledge taxonomies. Designing of measurable math learning outcomes.

Assessment of pupils' and teachers’ performance (internal, external, diagnostic, formative and summative, criteria-based, teacher self-assessment)

Assessment as a part of the learning and teaching processes (assessment as learning, assessment for learning and assessment of learning)

Methods of monitoring and assessment of pupils' performance in math. Measurement of the level of achievement of set objectives and results.

Criteria-based assessment

Methods of monitoring and assessment of pupils' performance in math. Note taking. Self-assessment and peer assessment

Designing a math task in order to measure the set learning outcomes. Types of math tasks.

Designing of written and oral tests in order to measure the set learning outcomes.</td></tr>
</table>

	Standardised test. External assessment Formative and summative assessment. Evaluation. Feedback provided to pupils and parents.
Teaching types	☐ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☐ Laboratory ☑ Mentoring ☑ Radionice ☐ ☐ ☐
Student obligations	Students are obliged to attend the class, to actively participate in all types of educational programs, to submit and present their seminar papers and to pass the final evaluation
Monitoring student work	see table below
Assessment and evaluation of student work	Students attending the course regularly (over 90% of the class), who received a positive evaluation for writing and presenting of their seminar paper are entitled to a signature. Students entitled to a signature are evaluated based on the grades on the seminar paper (65%) and the final exam (35%). Seminar paper Seminar paper comprises the actual written work and the presentation. It accounts for 65% of the total grade. Final exam Final exam can be administered either in writing or orally, during the regular exam periods. All students getting the passing grade on the seminar paper are allowed to take the final exam. The final exam is considered as passed if a student earns one of the passing grades.a.
Required literature	see table below
Supplementary literature	M. Niss, Investigations into assessment in mathematics education: an ICMI Study,2nd reprint, Springer, 2010 Miller-Linn-Gronlund, Mesurement and assessment in teaching, 10th edition, Pearson Education Inc, 2009

Monitoring student work:

Class attendance	0.8	Research		Practical work	
Experimental work		Paper			
Essay		Seminar paper	1.4		
Colloquiums		Oral exam	0.8		
Written exam		Project			

Required literature:

Title	Number of copies available	Availability on other medium
C.R.Tobey, P. D. Keeley, Mathematics Formative assessment: 75 practical strategies for linking assessment, instruction and learning, Corwin Pr Inc, 2011.		
E. Depka, Designing assessment for mathematics		
N.E.Gronlund, Assessment of student achievement		
J.H. McMillan, Classroom assessment: principles and practice for effective instruction		
W. J. Popham, Classroom assessment: What teachers need to know		

	J. Dodge, 25 quick formative assessments for differentiated classroom, Scholastic Inc, 2009 Driscoll-Wood, Developing outcomes based assessment for learner-centered education, Stylus Publishing, 2007. W. J. Popham, Transformative assessment, ASCD, 2008. C. Walker, E. Schmidt, Smart tests, Pembroke Publishers Limited, 2004
Quality assurance	In the final week of this course an anonymous survey will take place in order for students to evaluate the quality of the class. At the end of each semester an analysis of students' success at the test (trial) teaching lessons in the relevant semester. tru.
Other (in the opinion of the proponent)	

Subject name	Green Chemistry		
ID	PMC209	Study year	1.
Lecturer	doc. dr. sc. Viljemka Bučević Popović izv. prof. dr. sc. Renata Odžak	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 15, S: 0, E: 15, P: 0
Subject status	Compulsory	Online percentage	10%

Subject description

Subject goals	The objective of the course is to get acquainted with the basic principles of green chemistry and the procedures that lead to the reduction or complete elimination of the use of harmful substances in chemical reactions.
Enrolment requirements	None.
Learning outcomes	After completion of the course, the student will be able to: 1. define and understand the basic principles of green chemistry, 2. explain the catalytic action of 'green' catalysts, 3. define and understand the benefits of alternative reaction media and methods of conducting chemical reactions, 4. discuss the benefits of using renewables, 5. discuss the possibilities of applying green chemistry in finding environmentally friendly ways of solving global problems.
Syllabus	lectures: 1. Introduction to Green Chemistry. The basic 12 principles of green chemistry. (2 hours) 2. Toxicity of chemical substances. Methods for determining toxicity, LD50. (2 hours) 3. Waste, production prevention and recycling methods. (2 hours) 4. Biocatalytic reactions in the green approach to chemical processes, selected examples of biocatalytic processes. (2 hours) 5. Renewable energy sources and raw materials, selected examples of renewable energy sources. (2 hours) 6. Problems related to the use of organic solvents and alternative media for conducting chemical reactions (supercritical fluids and ionic liquids). (2 hours) 7. Alternative methods of conducting chemical reactions (microwell and photocatalytic reactions, solvent-free reactions). (3 hours) exercises: Experimental procedures modeled on the principles of green chemistry (15 hours)
Teaching types	☑ Lectures ☐ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☐ Multimedia ☑ Laboratory ☑ Mentoring ☐ ☐ ☐ ☐
Student obligations	

Monitoring student work

Class attendance	0.5	Research		Practical work	
Experimental work	0.5	Paper			
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam	1	Project			

Assessment and evaluation of student work	Written exam - 100%

Required literature

Title	Number of copies available	Availability on other medium
Mike Lancaster, Green Chemistry, AnIntroductory Text (treće izdanje), RSC, Cambridge, 2016.		
Lectures in pdf format		available

	Interna skripta za vježbe (Odžak, Bučević Popović)		
Supplementary literature			
Quality assurance	The quality of teaching will be monitored by collecting feedback from students through personal consultations, community discussions and an anonymous student survey. Students' performance in the final exam will be analyzed and used to improve teaching performance in the next academic year.		
Other (in the opinion of the proponent)			

Subject name	Scientific Communication		
ID	PMP105	Study year	1.
Lecturer	izv. prof. dr. sc. Bernarda Lovrinčević	Points value (ECTS)	2.0
Associates		Class execution (number of hours in semester)	L: 20, S: 10, E: 0, P: 0
Subject status	Elective	Online percentage	50%

Subject description	
Subject goals	– developing the ability to communicate with the general population, especially young people, on scientific topics – acquiring the skills needed to popularize science – introduction to the process of publishing a scientific paper and the structure of the Croatian scientific community – presentation of scientific content in written and audiovisual form in a way that is appropriate for non-scientific audiences, but also for other scientists
Enrolment requirements	
Learning outcomes	1. present the scientific problem, its analysis and results in the form of a text intended for non-scientific audiences, 2. recognize the most important results and conclusions of the scientific text in order for the wider (non-scientific) audience to get the correct information, avoiding the use of too professional language and expressions, 3. present a scientific topic in audiovisual form (short film, interview, etc.) with the aim of popularizing science, 4. present the scientific problem, its analysis and results in discussion with fellow scientists.
Syllabus	1. Introduction to scientific communication. Essay writing. 2. How to successfully communicate about science with a non-scientific audience. 3. How to write a scientific paper. 4. The process of publishing a scientific paper. Scientific bases. 5. How to successfully hold a scientific presentation at a conference. 6. How to successfully present your work in the form of a poster. 7. How to successfully present your work in the form of a video (documentary, interview). 8. How to present your work through a website. 9. Classification of scientists in Croatia (scientific conditions). 10. Science journalism: challenges of the digital age. 11. The role of scientists in the public. How does one become a science popularizer? 12. Scientists as Popular Persons: Advantages and Disadvantages. 13. Popular science books: from public education to science bestsellers. 14. Science and technology in film art. 15. Presentation of student homeworks and projects. 2S
Teaching types	☑ Lectures ☑ Seminars ☐ Exercises ☐ Fully online ☐ Combined online ☐ Fieldwork ☑ Individual assignments ☑ Multimedia ☐ Laboratory ☐ Mentoring ☐ ☐ ☐ ☐
Student obligations	1. The student is required to attend lectures and seminars, at least 70% of lectures and 80% of seminars. 2. The student is required to make a project in the form of a video aimed at promoting science. 3. The student is required to write homework.

Monitoring student work:

Class attendance	1	Research		Practical work	
Experimental work		Paper		Homework assignments	0.5
Essay		Seminar paper			
Colloquiums		Oral exam			
Written exam		Project	0.5		

Assessment and evaluation of student work	1. Homework – 30% of the grade. 2. Project – 70% of the grade.

Required literature	Title	Number of copies available	Availability on other medium
	D. Meredith, Explaining Research: How to Reach Key Audiences to Advance Your Work (2010, Oxford University Press, USA)		web
	Routledge Handbook of Public Communication of Science and Technology (2014, Ed. M. Bucchi, B. Trench, 2nd edition, Routledge, London).		web
Supplementary literature			
Quality assurance	1.Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split. 2. Talking to students and monitoring their homework activities.		
Other (in the opinion of the proponent)			