NAME OF THE COURSE	Astrophysics I					
Code	PMP131	Year of study	DS-1			
Course teacher	doc.dr. sc. Koraljka Mužić	Credits (ECTS)	6.0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30		30	
Status of the course	mandatory	Percentage of application of e-learning	25%			

COURSE DESCRIPTION	
Course objectives	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.
Course enrolment requirements and entry competences required for the course	None.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	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.
Course content broken down in detail by weekly class schedule (syllabus)	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.
Format of	☒ lectures	☒ independent assignments

<table>
<tr><td>instruction</td><td colspan="3">☐ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☒multimedia
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attendance: at least 70% of the lectures and 70% of the exercise sessions.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td></td><td>Research</td><td>0.6</td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1.2</td><td>Oral exam</td><td>2</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.2</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">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%).</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">[1] D. A. Ostlie and B. W. Carrol, “An Introduction to Modern Astrophysics”, 2nd ed. Addison Wesley (2017).</td><td>1</td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">[1] R. Kippenhahn and A. Weigert, “Stellar Structure and Evolution”, Springer-Verlag, Study edition (August, 1994).
[2] C. J. Hansen, S. D Kawaler & V. Trimble, “Stellar Interiors – Physical Principles, Structure, and Evolution”, Springer (2004).</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">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 (as the proposer wishes to add)</td><td colspan="6"></td></tr>
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