<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">General Physics IV</td></tr>
<tr><td>Code</td><td>PMP007</td><td>Year of study</td><td colspan="4">2</td></tr>
<tr><td>Course teacher</td><td>Prof. Mile Dželalija, PhD</td><td>Credits (ECTS)</td><td colspan="4">8,0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Ass. Prof. Željka Sanader Maršić, PhD</td><td rowspan="2">Type of instruction (number of hours)</td><td>P</td><td>S</td><td>V</td><td>T</td></tr>
<tr><td>60</td><td>15</td><td>30</td><td></td></tr>
<tr><td>Status of the course</td><td>Compulsory</td><td>Percentage of application of e-learning</td><td colspan="4">20 %</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">To introduce students to thermodynamic laws and logic of conclusion using the term reversible process; significance of entropy in thermodynamics, statistical physics, theory of information; the principle of the maximum information entropy; cooling principles, phase transitions, thermodynamic description of solutions and chemical reactions, transport processes</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Knowledge of Newton's Law and Conservation Law
The basic properties of the two variables function, derivability and development in Taylor's order</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">• Distinguish physical access to systems with a large number of particles in relation to approaches in chemistry and biology
• Analyse processes using the Kelvin Formulation of the 2nd Law of Thermodynamics
• Describe the importance of return processes in thermodynamic analysis
• Formulate the 2nd law of thermodynamics through the Clausius relationship and entropy of the closed system
• Explain the importance of the 3rd law of thermodynamics on the example of comparison of Sackur-Tetrode's excerpt for ideal gas entropies and experimental results
• Analyse the principle of cooling van der Waals' gas with the Joule-Thomson effect
• Define phase crossings, discuss Clausius-Clapeyron's jargon
• Analyse the change of pressure and phase transition temperature for curved dividing surfaces
• Connect the metastable states of the staple phase curvature curve material and explain why the stack of the stack has a low probability of further growth
• Analyse the mean of the mean free path in the transport coefficients of ideal gas
• Describe manifold systems by dynamical, thermodynamic and statistical method</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1. Description of manybody systems by dynamical, thermodynamic and statistical method; The ideal gas model. Diagrams of the isothermal, isobaric and adiabatic processes in the p, V diagram
2. Internal energy; Work; Heat; The first law of thermodynamics
3. Thermal capacity; The importance of thermal capacity versus experimental theory testing. Mayer's relationship. Importance of heat capacity dependency on the temperature for the development of quantum physics
4. Second law of thermodynamics; Kelvin's and Clausius's second-law thermodynamic formulation. Clausius's relationship. The second law of thermodynamics and entropy increase in a closed system; A maximum efficiency and maximum power of the cycle
5. Boltzmann's definition of entropy. Reversibility of dynamic processes and irreversibility of the processes in nature. Gibbs' definition of entropy; Shannon's definition of information entropy. The difference between</td></tr>
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	information and thermodynamic entropy 6. Jaynes' principle of the maximum information entropy. Derivation of Gibbs 'distribution by Jaynes' principle of maximum information entropy 7. The third law of thermodynamics; Inability to achieve absolute zero. Thermodynamic potentials. Helmholtz's free energy, enthalpy and Gibbs free energy. Maxwell Relationships. 8. Van der Waals's equation of real gas. Maxwell's construction. The law of corresponding states. 9. Phase transitions; Definition of phase transitions. Phase diagram, lines of coexistence, Clausius-Clapeyron equation, boiling, saturated vapor pressure dependence on temperature. 10. Solutions; Osmosis and vant Hoff's equation. Rault's and Henri's law. 11. Systems that exchange particles. Chemical potential and systems that exchange particles. Construction of a phase diagram with chemical potentials. 12. Gibbs's distribution for systems that exchange particles. Application to quantum systems of identical particles. Fermi-Dirac and Bose-Einsten distribution. 13. Chemical reactions. Exothermic and endothermic reactions. Mass law. PH factor. 14. Surface Effects. Surface Pressure. Metastable conditions and changes of phase transition temperature on curved surfaces 15. Transport phenomena. Mean free path, diffusion coefficient, thermal conductivity. 16. Ideal gas viscosity. A Poisseuille formula.
Format of instruction	Lectures using presentations, interactive simulations, performing demonstration experiments, solving selected task examples, both individually and in the group, discussing and solving the problem. Solving tasks at auditory exercises, independently and with the guidance of the assistant, and student presentations and discussion of individual topics at the seminar.
Student responsibilities	Passed exams: Numerical problems and theories. Success in each of at least 50%. - actively participate in the classes with their comments, questions and answers to the questions - prepare and present the seminar work on the selected topic - solving numerical tasks by applying the concepts and laws in the content - critically discuss selected concepts and laws and their applicability
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)*	2 ECTS: preparation and presentation of the seminar 3 ECTS: active participation in the lectures and independent learning of the theoretical concepts and laws of the mentioned contents 3 ECTS: active participation in exercises and self-exercising solving complex numerical problems
Grading and evaluating student work in class and at the final exam	- preparation and presentation of the seminar (15%) - Critical Discussion of Terms and Laws (45%) - Solving Numerical Complex Problems (40%)
Required literature (available in the library and via other media)	P. Županović: Termodinamika s elementima statističke fizike, Element, Zagreb, 2016. M- D.Halliday, R.Resnick, J.Walker, Fundamentals of Physics, JW and Sons, 6th edition, extended, 2003; or later - M.Dželalija, General Physics III, presentations, 2018.

Optional literature (at the time of submission of study programme proposal)	• L. D. Landau, A. I. Akhiezer, and E. M. Lifshitz: General Physics. Mechanics and Molecular Physics, translated from the Russian edition (Moscow, 1965). • Matveev: Molecular physics, Mir, Moscow, 1985.
Quality assurance methods that ensure the acquisition of exit competences	- Analysis of learning outcomes at the end of class versus initial screening. - monitoring student development on the following subjects and links to the success of this subject - other student surveys
Other (as the proposer wishes to add)	