Mechanics and Thermodynamics. GEFIT 251 FIT/32K
Curriculum and Requirements
2018/2019. II. semester

Curriculum:

7. week Basic concepts of kinematics. Motion, mass point, reference system. Position vector, velocity, acceleration. Tangential and normal components of acceleration. Description of motion in different coordinate systems: Cartesian, plane polar and cylindrical coordinate systems.
8. week Kinematics of special types of motion. Rectilinear uniform motion, uniformly accelerated motion, projectile motion and circular motion.
9. week Relative velocities. Fundamental concepts of particle dynamics. Mass and momentum. Newton's I. Law. Newton's II. Law (axiom of force).
10. week Force laws. Newton's III. Law (axiom of action-reaction). Definition of instantaneous power, kinetic energy and work done by a force. Law of power, work-energy theorem. Force field. Conservative forces. Introduction of potential energy.
11. week Connection between force and potential energy. Conservation of mechanical energy. Non-conservative forces. Fundamental concepts of oscillations. Linear restoring force. Equation of motion of simple harmonic oscillation and solution of the differential equation. Potential energy of a simple harmonic oscillator.
12. week Energy considerations in case of simple harmonic motion. Damped oscillations. Equation of motion of damped oscillation and solution of the differential equation in case of weak damping. Forced oscillations. Equation of motion of forced oscillation and solution of the differential equation.
13. week Resonance. Definitions of Definition of static momentum-, angular momentum-, and torque relative to point A. Relation between angular momentum and torque. Central forces. Definition of sector velocity. Connection between sector velocity and angular momentum. The law of universal gravitation. Concept of gravitational mass. Gravitational potential energy. Gravitational field intensity, and potential.
14. week The motion of planets in gravitational field. Kepler's Laws. Basic concepts of dynamics of system of particles. Centre of mass, external and internal forces. Equation of motion of the centre of mass. Angular momentum of a system, kinetic energy of a system.
15. week System and environment. Thermodynamic variables. Extensive and intensive state variables. Thermal equilibrium. The zero-th. law of thermodynamics. Internal energy. Concept of work done by the environment. Concept of heat. The first law of thermodynamics.
16. week Concept of temperature. The ideal gas temperature scale. The state equation of ideal gas. Ideal gas microscopic description. Assumptions of the kinetic theory. Calculation of pressure. Kinetic interpretation of temperature. Number of degrees of freedom. Principle of equipartition of energy.
17. week The application of the first law of thermodynamics for special transformations. Isochoric process, isobaric process, isothermal process and adiabatic process. Constant volume and constant pressure specific heats. Robert-Mayer equation.
18. week Cyclic process. Heat engine, refrigerator. Reversible and irreversible processes. The Carnot cycle. The thermal efficiency. Speed distribution of the molecules in gas. Most probable speed, average speed, root-mean square speed. Thermal expansion of solids.
19. week Heat transfer. Heat conduction, the equation of linear conduction. Convection and radiation. Reversible and irreversible processes. The second law of thermodynamics. The efficiency of engines. Entropy and reversible processes. The mathematical form of the second law.
20. week Summary.

Curriculum of Mechanics and Thermodynamics
Practical Lessons
The practical lessons are connected to the subjects of the lectures. On the practical lessons selected problems are solved from the subjects of the previous lecture, week to week. So the students practice the definitions, laws, theorems. They practice to apply their mathematical knowledge on physical problems solution. The test is also written on practical lesson.

The requirements for signature and final examination.
The students write one or two getting signature tests during the semester. The test contains problems from different subjects of physics. The qualification of the test is ”pass” or ”fail”. In case of ”fail” the test can be repeated on the last week of the semester.

Requirements for getting signature:

1. students have to attend more than half of the practical lessons,
2. have to pass on the getting signature tests, or on the repeated test.

If somebody does not get signature at the end of semester, because does not fulfill the first condition above, but the Dean of Faculty gives him or her one more chance to get it, the student has to report from the whole subject at the lecturer.

If somebody does not get signature at the end of semester, because does not fulfill the second condition above, he or she can write a getting signature test, during the examination period, until a given date decided by the Dean of Faculty.

Conditions of final examination:

Before the oral exam there is a minimum test with physical formulas. The total scores are 20. 14 scores needed to pass. After that there is an oral exam. The students get two themes from the whole subject of the semester. The student has to pass from both for a successful exam

Books, recommended literature:

[1] Halliday and Resnic: Fundamentals of Physics, John Wiley & Sons, 1981.
[2] Alonso and Finn: Fundamental University Physics I, II, Addison-Wesley Pub., 1980.
[3] Sears, Zemansky & Young: University Physics, Addison-Wesley Pub., 1987.
[4] Savelyev: Physics I, II, Mir Publishers, 1980

Miskolc, 04. february. 2019.

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