Electrodynamics and Optics GEFIT 252B-a FIT/32K
Curriculum and Requirements
2018/2019. I. semester

Curriculum:

37. week Basic concepts of electrostatics. Electric charge. Fundamental building blocks of matter. Electric field intensity. The superposition principle. Force between point charges, Coulomb's law. Potential difference between two points.
38. week Potential at an arbitrary point. The first law of electrostatics. Equipotential surfaces. Electric field and potential due to a point charge. Electric dipole. Torque acting on a point like dipole. Polar, and non-polar molecules. Electric polarization vector. Electric induction vector.
39. week Field lines of induction. Electric flux. Gauss's law of electrostatics. Boundary conditions. Conductors in electrostatic field. Capacitance of an isolated conductor.
40. week Capacitance of an isolated conductor sphere. Parallel plate capacitor. Capacitors in parallel, capacitors in series. Energy storage in electric field.
41. week Energy density in electric field. Current and current density. Current density in a metallic conductor. The drift speed of charge carriers. Conservation of charge, continuity equation. Electromotive force.
42. week Extraneous forces, seat of emf. Stationary electric field. Boundary conditions. Differential form of Ohm's law. Electrical conductivity and resistivity. Integral form of Ohm's law. Resistance of a homogeneous thin resistor. Resistivity temperature dependence. Ohm's law for a simple closed circuit.
43. week Terminal potential difference. Multiloop circuits and Kirchoff's rules. Problem solving strategy. Applications of Kirhoff's rules: series-, parallel connection, potential divider, broaden the range of ammeter, voltmeter, Wheatstone bridge.
44. week Work and power in stationary current circuit. Basic magnetic phenomenon. Introduction of magnetic induction by Ampere's force. Lorentz's force. Cyclotron. Torque acting on a plane current loop. Magnetic dipole momentum.
45. week Lines of magnetic induction. Gauss's law for magnetism. Magnetization vector. Introduction of magnetic field strength vector. Magnetic properties of materials. Paramagnetism, diamagnetism, ferromagnetism. Hysteresis curve.
46. week Curie temperature. Ampere's law for magnetic field. Boundary conditions. Magnetic field due to a long solenoid. Biot-Savart law for a current element. Electromagnetic induction due to motion of conductor. Neumann's law. Flux rule. Emf induced by a rotating coil.
47. week Induction due to change of flux linkages. Mutual-, self induction. Faraday's law of induction. Self inductance of a long solenoid. Mutual inductance of two closely wound coils. Generalization of loop theorem. Energy in an inductor, magnetic energy density.
48. week Forced electrical oscillation in a serial RLC circuit. The complex representation. Complex and real impedance. Complex Ohm's law. Instantaneous voltages across the different circuit element. Phasor diagram. Effective or root-mean-square value. Power in alternating current circuit. The Ampere-Maxwell equation. Displacement current density. The Maxwell's equation system. Constitutive equations
49. week Electromagnetic waves. Wave equation in homogeneous isotropic insulator. Travelling plane wave solution. Phase velocity. Concept of wave front. Monochromatic wave. Wavelength wave number vector. Transverse wave. Propagation of energy in electromagnetic waves.
50. week The Poynting vector or energy current density. Intensity. Interference phenomenon. Interference term. Conditions of interference. Coherent waves. Behaviour of waves at the interface of two media. Reflection and refraction. Ray concept. Snell's law. Absolute and relative refractive index. Dispersion.

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 fulfil 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 fulfil 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. At least 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, 1. september. 2018.

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