HEC 107: Foundation Physics II

By
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Course name	**Foundation Physics II**
Course code	**HEC 107**
Level of course	Year 1, Semester 2
Credit units	4
Brief course description	This second course will provide students with an in-depth introduction to electromagnetism, atomic and nuclear physics as well as an introduction to optical physics. The course will also help them understand how a given physical phenomena works so that, given an initial situation, you can predict what will happen next. The entire course will be delivered through a combination of theoretical lectures, problem-solving tutorials and laboratory-based practical. Laboratory sessions are expected to reinforce theory and also instill sound laboratory practices. Practical should enable students to increase their competence in numeracy, ICT, communication, teamwork and independent learning skills.
Objectives	This course is intended to: 1. To provide students with scientific knowledge about the basic laws and principles and to learn how to apply them in their respective undergraduate courses. 2. Demonstrate analytical and problem solving skills at the introductory level, as evidenced in electricity, magnetism and physics. 3. Develop the ability of the students to conduct, observe, analyze and report an experiment. 4. Provide students with the ability to deal with physical models, mathematical formulas and solve numerical problems. 5. Enhance intellectual, communication and analytical skills of the students. 6. Enhance the ability of the students to seek, acquire and process data from different sources using the library and the internet.
Learning outcomes	After successful completion of this course, the students should be able to:

	1. Demonstrate analytical and problem solving skills required to progress successfully into undergraduate study in engineering, physical and mathematical sciences. 2. Have the skills required to recognize and apply the concepts and principles of physics most relevant to a range of problems in the physical sciences and Engineering. 3. Have the practical skills required to do simple laboratory experiments. 4. Interpret the data from laboratory experiments in the context of relevant theories. 5. Should be able to acquire and process data from different sources using the library and the internet.
Mode of delivery	The course will be taught by using lectures, tutorials, Laboratories and assignments.
Mode of assessment	Coursework = 30% Examination = 70% Total =100%
Content	**WEEKS** **HOURS** **Week 1** **4 hours** **Electromagnetism:** Electric charge; Coulomb's law; electric field/field lines; electric flux; Gauss's law; electric potential; capacitors; parallel plate capacitor; direct current; conductors and semiconductors; drift velocity. **Week 2** **4 hours** **Electromagnetism:** Ohm's law; resistors; Kirchhoff's laws, potential dividers; potentiometers; meter bridge; electrical power; magnetism; magnetic field/field lines. **Week 3** **4 hours** **Electromagnetism:** Force on moving charge; Ampère's law and applications; solenoids; magnetic flux; magnetic induction; Faraday's law; Lenz's law; inductance; energy stored by inductor; transformers; alternating current, rectification.

	Week 4 **4 hours** **Wave motion:** Transverse and longitudinal waves, wavelength, frequency, velocity, amplitude, reflection of a wave, superposition of waves. **Week 5** **4 hours** **Wave motion:** Standing waves, nodes, beat frequencies, diffraction, interference, coherence. **Week 6 &7** **8 hours** **Sound:** The production of sound, relative speed of sound in solids, liquids and gases, Intensity of sound, decibel units, Frequency response of the ear, pitch, harmonics, resonance in air columns and strings, Doppler effect, ultrasound and its applications. **Week 8** **4 hours** **Atomic and nuclear physics:** Rutherford scattering experiment. The wave/particle nature of light. The photo-electric effect; The photon and atomic structure. **Week 9** **4 hours** **Atomic and nuclear physics:** The Bohr model of the hydrogen atom. The spectrum of atomic hydrogen; X-rays. X-ray production; Spectra; Absorption. **Week 10** **4 hours** **Atomic and nuclear physics:** Atoms, nuclei and radiation, Atomic number, atomic weight, isotopes; Stability of nuclei. Mass defect and nuclear binding energy. **Week 11** **4 hours** **Atomic and nuclear physics:** **Natural radioactivity:** alpha, beta and gamma radiation. Sources of radiation. Half-life; Equation of radioactive decay. **Week 12** **4 hours** **Optical Physics.** The electromagnetic spectrum, colours, black-body radiation, polarization, wave rays and photons.

	Week 13 **4 hours** **Optical Physics.** Reflection and refraction at plane surfaces and prisms; law of reflection, Snell's law, refractive index, critical angle, total internal reflection. **Week 14** **4 hours** **Optical Physics.** Optical fibers, prisms, dispersion, spectroscopic instruments. Reflection/refraction at curved surfaces: imaging with spherical mirrors and thin lenses, magnification, determination of focal length. **Week 15** **4 hours** **Optical Physics.** Use of the formula 1/u + 1/v = 1/f with sign convention. Combination of thin lenses. Optical Instruments: camera, the eye, the telescope, the microscope, effect of lens aberrations and diffraction on performance. **Week 16 & 17** Examinations
Study materials	1. Paul A. Tipler, Gene Mosca (2008), *Physics For Scientists and Engineers With Modern Physics,* New York. 2. JPhO (2014), *Olympiad Physics Basic To Advanced Exercises,* World Scientific Publishing Co. Pte. Ltd. 3. Advanced Level Physics, Muncanster. 4. Advanced Level Physics, Nelkon and Parker