King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 3

General Physics I **PHYS 110**

This unit covers physical quantities, dimensional analysis, vectors, motion in one dimension, motion in a plane, Newton's laws, friction, work and energy, linear momentum, impulse, center of mass and collisions, and rotational motion.

PRE-REQUISITES: None

Credits 1

Safety Awareness **PHYS 200**

This course introduces what to do when emergencies occur, including escape routes, emergency phone numbers, and location and use of emergency equipment (e.g., alarms, eyewashes, showers, fire extinguishers, spill kits). The course will cover broadly the major topics given below. The major safety topics that the students in the physics labs should understand are:

1. Student responsibilities.
2. General safety precautions in the laboratories.
3. Working with electricity.
4. What is dangerous about electricity?
5. High voltage safety & electronics equipment considerations.
6. Compressed gas cylinders.
7. General precautions when using lasers.
8. Radiation safety: x-radiation and nuclear radiation.
9. What to do if an injury incident occurs.
10. First aid.

PRE-REQUISITES: None

Credits 1

General Physics Lab **PHYS 281**

The experiments and applications of this laboratory are described very closely in accordance to the topics of General Physics I.

PRE-REQUISITES: PHYS 110

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 2

Training I **PHYS 390**

In this training course, students will have several visits to university hospital to involve them in medical applications and the proper use of the medical devices.

PRE-REQUISITES: Approval of the Department

Credits 4

General Physics III **PHYS 203**

The course covers Oscillations, fluid mechanics, Elasticity, wave motion, Acoustic Phenomena, temperature, quantity of heat, thermal Expansion, Heat transfer, Thermal of matter, Reflection, Refraction, Images from planes and spherical mirrors and surfaces.

PRE-REQUISITES: PHYS 110, MATH 110

Credits 4

General Physics II **PHYS 202**

The course reveals the electric and magnetic concepts, including the charge and electric force, electric field, Gauss' law, electric potential, capacitance, electric current and resistance, DC circuits, magnetic force, magnetic field, induction and inductance, magnetism of matter and Maxwell's equations.

PRE-REQUISITES: PHYS 110, MATH 110

Credits 3

Thermodynamics **PHYS 221**

The course introduces basic principles of thermodynamics, First law of thermodynamics, Specific heat for ideal gases, Carnet's cycle, Entropy and equilibrium, Chemical potential, Maxwell's equations, Properties of pure materials, Change of Phase, Clausius-Clay Peron equation, Vapor pressure, Kinetic theory of gases, Principle of equipartition of energy, Specific heat capacity of solids.

PRE-REQUISITES: PHYS 203, MATH 202

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 3

Modern Physics I **PHYS 241**

The course introduces the the special theory of relativity, hypothesis, Galilean and Lorentz transformation. Relativistic dynamics, photoelectric effect, Black body radiation, the Compton effect, Photon, DeBoglie's hypothesis, Uncertainty principles, wave packet basics properties of atoms, Thomson model, the Rutherford model, Bohr's model the Frank-Hertz experiment, the correspond principle, Wilson-Sommerfeld theory, Sommerfeld relativistic theory.

PRE-REQUISITES: PHYS 202, MATH 202

Credits 4

Mathematical Physics I **PHYS 251**

The course introduces vector analysis, gradient, divergence, curl; Gauss' and Stokes' theorems; orthogonal curvilinear coordinates. Elements of complex algebra, De Moivre's theorem. Matrix, determinant and their important algebraic properties. Ordinary differential equations of the first and second order with constant and variable coefficients.

PRE-REQUISITES: PHYS 202, MATH 202

Credits 3

Classical Mechanics I **PHYS 252**

This unit covers fundamental concepts of vectors, Newtonian mechanics, rectilinear motion of a particle, the harmonic oscillator, general motion of a particle in three dimensions, noninertial-reference systems, central forces and celestial mechanics.

PRE-REQUISITES: PHYS 110, MATH 202

Credits 3

Optics **PHY 311**

This unit explains wave motion, electromagnetic theory, the superposition of waves, polarization, diffraction, interference and the basic of coherence theory.

PRE-REQUISITES: PHYS 241

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 3

Electronics Circuit I **PHYS 312**

The course covers study of Electric current starting from Ohm's law and their applications in Electric, circuits, including the study of current & voltage AC & DC source. The laws of Kirchhoff and methods of solving DC circuits, Elements of A.C circuits and their components (Capacitance & inductors), Representing voltage & currents through the concept of phasors, Methods to solve AC & DC circuits using Thevnin and Norton methods, Diodes & rectification of AC voltages, Smoothing circuits, power supplies, Transistors, biasing and circuit configurations and transistor with small signal model.

PRE-REQUISITES: PHYS 202, MATH 202

Credits 3

Electromagnetism I **PHYS 331**

This unit covers vector analysis, Electrostatics, work and energy, Special techniques in calculating potential (Laplace's equation, the method of images), Electromagnetic fields in mater (Polarization, electric displacement, linear dielectrics).

PRE-REQUISITES: PHYS 202, PHYS 251

Credits 3

Electromagnetism II **PHYS 332**

This unit covers light rays – light waves – light propagation in matter – optical images – coherence and interference measurement – light and matter – Lasers – Laser dynamics – semiconductor laser – light sensors.

PRE-REQUISITES: PHYS 331

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 3

Modern Physics II **PHYS 342**

This unit explains Schrödinger equation and its applications, the hydrogen atom in quantum physics, quantum numbers, angular momentum, intrinsic spin, energy levels and spectroscopy, Zeeman effect; fine structure, the Pauli's exclusion principle, the periodic table, properties of elements, x-ray, optical spectra, the band theory in solids, electrons in metals, superconductivity, semiconductors. Nuclear structure and
Radioactivity.

PRE-REQUISITES: PHYS 241, PHYS 251, PHYS 252

Credits 4

Mathematical Physics II **PHYS 352**

The course introduces Special functions of mathematical physics, Hermite polynomial, Legendre and associated Legendre polynomials, Laguerre and associated Laguerre polynomials, Bessel and spherical Bessel functions and their important properties. Fourier series, Fourier and Laplace transforms and their simple applications. Elements of probability theory, random variables, expectation values, probability distributions. Elements of group theory.

PRE-REQUISITES: PHYS 251

Credits 3

Classical Mechanics II **PHYS 353**

The structure of this course consists of the system of particles, angular momentum, lab and centre of mass coordinate systems, mechanics of rigid bodies, the physical pendulum, laminar motion, collision of rigid bodies, motion of rigid bodies in three dimensions, Euler’s equations, gyroscopic motion, motion of a top, gyrocompass, inertia tensor, Lagrangian mechanics, generalized coordinates, Hamilton’s variational principle, Hamiltonian equation, dynamics of oscillating systems, normal coordinates, coupled harmonic motion, continuous system and the wave equation.

PRE-REQUISITES: PHYS 252

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 3

Quantum Mechanics **PHYS 354**

Topics covered include the basic ideas of wave function, probability density, The operators in quantum mechanics, The Schrödinger equation and its applications in one, two and three dimensions such as free particle, step potential, barrier potentials, particle in a box and the harmonic oscillator, solution of the Schrödinger equation for the hydrogen like atom, the concepts of orbital angular momentum and spin angular momentum. The spin orbit interaction.

PRE-REQUISITES: PHYS 342, PHYS 353

Credits 1

Modern Physics Lab **PHYS 381**

In this course the experiments and applications of this laboratory are described very closely in accordance with the topics of PHYS 241 and PHYS 342.

PRE-REQUISITES: PHYS 342

Credits 1

Electronics Lab **PHYS 382**

In this course the experiments and applications of this laboratory are described very closely in accordance with the topics of PHYS 312.

PRE-REQUISITES: PHYS 312

Credits 1

Optics Lab **PHYS 383**

In this course the experiments and applications in this laboratory are described very closely in accordance with the topics of PHYS 311.

PRE-REQUISITES: PHYS 241

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 3

Statistical Mechanics **PHYS 456**

Review of the three thermodynamics laws, Introduction to statistical physics (a particle in a box, energy levels, microstates, macrostates, entropy). Statistical thermodynamics (distribution of energy between systems in equilibrium, equilibrium of a system in a heat bath, the partition function). The heat capacity of solids, black body radiation (the partition function of photons, properties of black body radiation). The perfect classical gas (the partition function of the gas, the Maxwell velocity distribution). The perfect quintal gas (the partition function of Bosons and Fermions, the Fermi-Dirac and Bose-Einstein distribution).

PRE-REQUISITES: PHYS 221, PHYS 354

Credits 3

Nuclear Physics **PHYS 461**

The course concentrates on the general properties of the nucleus, nuclear stability, stability line and the table of nuclei. Binding energy, separation energy. The liquid drop models. Nuclear decay law, half-life, mean life-time and radioactivity. Decay schemes. Production of radioactive materials. Alpha decay, Beta decay, Gamma

PRE-REQUISITES: PHYS 354

Credits 3

Solid State Physics **PHYS 471**

Topics usually covered are crystal structure, crystal diffraction, crystal binding, lattice vibration, thermal properties, free electron theory and energy bands.

PRE-REQUISITES: PHYS 354

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 1

Nuclear Physics Lab **PHYS 484**

The experiments and applications of this laboratory are described very closely in accordance to the topics of PHYS 461.

PRE-REQUISITES: PHYS 461, PHYS 200

Credits 1

Solid State Physics Lab **PHYS 485**

The experiments and applications in this laboratory are described very closely in accordance to the topics of PHYS 471.

PRE-REQUISITES: PHYS 471, PHYS 200

Credits 3

Special Relativity **PHYS 343**

Revision of the relativistic ideas discussed in PHYS 241. Physics before relativity and the Newtonian relativity. Relativistic kinematics: Einstein's postulates of the relativity and their consequences. The four-dimensional space and the space-time invariant interval. Relativistic dynamics: Energy, momentum, and conservation of energy and momentum. Relativistic collisions and Compton effect. A gentle introduction to general relativity.

PRE-REQUISITES: PHYS 241

Credits 3

Special Topics **PHYS 392**

This course can be of a theoretical or experimental nature. The course content must be approved by the department's board every time a new subject is offered.

PRE-REQUISITES: Approval of the Department

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 3

Computational Physics **PHYS 393**

The course concentrates on using the latest programming languages which will include, statements, functions, loops, roots, integration, solving differential equations, matrices, set of simultaneous equations and graphics. In addition to a very carefully selected set of problems in mathematical physics and numerical analysis requiring the application of programming languages in solving these problems.

PRE-REQUISITES: PHYS 342, PHYS 251

Credits 3

Laser Physics **PHYS 412**

This unit Introduces magnetic resonance imaging from the basic concepts to cutting edge applications. Basic physics of magnetic resonance, Resonance and detection, fundamentals of image formation, interpretation of images.

PRE-REQUISITES: PHYS 354, PHYS 311

Credits 3

Electronics Circuit II **PHYS 413**

The course introduces various types of modern transistors used in integrated circuits such as JFETS and MOSFETS. Applications of analogue transistor circuits. Voltage amplifiers, Oscillators, Operational amplifiers. Digital circuits such as Logic gates and digital counters.

PRE-REQUISITES: PHYS 312, PHYS 352

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 3

Microwave **PHYS 414**

The course introduces X-ray generators, tubes, and survey of mammography, fluoroscopy, image intensifiers, cine systems, radiodosimetry, image quality, CT scanners, ultrasound, and magnetic resonance imaging.

PRE-REQUISITES: PHYS 332, PHYS 312

Credits 3

Quantum Mechanics II **PHYS 455**

The course covers methods of approximate solutions of the Schrödinger equation including the perturbation methods, variational methods and WKB method. Identical particles, The multi-electron atoms and the Zeeman effect.

PRE-REQUISITES: PHYS 354

Credits 3

Radiation Physics and Detectors **PHYS 462**

The course covers radiation sources (standard sources and radiation machines), interaction of radiation with matter and the biological effects of radiation, counters and detectors (solid, liquid, gaseous), pulse processing and analysis, particle identification methods, nuclear energy and safety applications.

PRE-REQUISITES: PHYS 461

Credits 3

Nuclear Models **PHYS 463**

The course covers nuclear two-body problem, nuclear force, Fermi gas model, nuclear shell model, the deformed shell model the collective model, vibrational and rotational models.

PRE-REQUISITES: PHYS 461

King Abdulaziz University
Faculty of Science
Department of Physics

Course Description for General Physics

Title **Code**

Credits 3

Semiconductors **PHYS 472**

This course which will be an introduction to the Physics of semiconductors and is designed to give the students an understanding of the technology and applications of semiconductor devices. It will cover the following topics: Energy bands, carrier concentration, carrier transport phenomena, p-n junction, bipolar and other devices.

PRE-REQUISITES: PHYS 471, PHYS 312

Credits 3

Physics Education Training **MPHY 493**

The physics topics covered by the students are in different subjects suitable for middle and high schools and in general subjects. The students will receive some educational and scientific directions.

PRE-REQUISITES: Approval of the Department