

مفردات المقررات الدراسية قسم الفيزياء كلية العلوم  
جامعة سبها

**Sebha University**  
**Faculty of Science**  
**Physics department**

**Description of Courses**

**PH101**

**Introductory Physics**

**Credits 2**

1-Units and Dimensions:

Units and dimensions of physical quantities.

2-Vectors and scalars:

Addition, Subtraction, Multiplication and resolution of vectors.

3-Motion in one dimension:

Newton's laws of motion, Work, Energy and Power, Conservation Laws, Translational and Rotational motion, Mass Energy relation.

4-Heat:

Temperature scale, Thermal expansion, heat capacity, 1<sup>st</sup> and 2<sup>nd</sup> Laws of thermodynamics.

5-Electricity:

Electric forces, fields, potential and current, resistance, series and parallel resistors, power in electrical circuits.

6-Modern Physics:

Basic principles of special relativity, quantum mechanics, atomic structure, Nuclear fusion and fission.

Text Book:

Introductory Physics.

Author: Mashri L. Warren.

Publishers: W. H. Freeman and Company.

**PH201**

**Mechanics I**

**Credits 3**

1-Physical quantities-Dimensions and Units.

2- Vectors-Addition and Resolution of vectors-vector products-Differentiation of vectors.

3-Kinematics of linear motion-Newton's laws –Friction.

4-Work-Energy-Power-Conservation of Energy.

5-Linear Momentum- Conservation of linear momentum.

6-Angular momentum-Torque-Conservation of angular momentum

7-Simple harmonic motion-simple pendulum-circular motion.

Text Book:

Physics for science and engineering, part I.

Author: Marion and Mornyak.

Publishers: W.B. Saunders Company.

Reference: Physics I.

Author: Resnick and Halliday.

Publishers: John Wiley and Sons

**PH202**

**Heat & Properties of matter Credits 3**

1-Temperature:

Thermal equilibrium-Temperature and zeroth law of thermodynamics-concept of temperature-Temperature scales-Gas thermometer-Thermal expansion and change of state.

2-Simple Thermodynamic Systems:

Thermodynamic equilibrium-PV and PT diagram for pure substance-Equation of state-Stretched wire-Surface film-Intensive and extensive quantities.

3-Heat and first law of thermodynamics:

Work and heat, specific heat of solids, adiabatic work, internal energy function, concept of heat, first law of thermodynamics, transport phenomena of heat, Kirchoff's law and Stefan-Boltzmann law.

4-Ideal gases:

Equation of state of a gas, Ideal gas, Quasi static adiabatic process, Equation of state of an ideal gas.

5-Second law of thermodynamics:

Introduction and elementary discussion.

6-Deformation of solids:

Tension by axial forces, stress and strain, elastic moduli.

7-Static fluids:

Stresses in a fluid at rest, Pressure within a fluid, The measurement of pressure, Buoyancy and Archimedes principle, Surface phenomena, Surface tension.

8-Fluid dynamics:

Streamlines and continuity, Bernoulli's equation. The energy equation, viscosity, The Reynold's number (flow pattern).

Text Book:

Physics for Science and Engineering.

Author: Marion and Hornyak.

Publisher: W.B. Saunders company.

**PH301**

**Mechanics II**

**Credits 3**

1-Coordinate systems-Cartesian, Polar, Cylindrical and Spherical coordinates-Transformation of coordinates.  
2-Centre of mass-Centre mass of regular rigid bodies- Moments of inertia of regular rigid bodies- Rotation of rigid bodies.  
3-Dynamics of rigid bodies- Rigidity conditions and many particle systems- Rolling motion-Kinetic energy of rolling objects-Translation and rotational of a rigid body.  
4-Rigid body motion-Rotation about an axis-The compound pendulum.  
5-Gravitation-Centre of gravitation for extended bodies-Gravitational field and the gravitational potential-Motion in an inverse square field.

Text Book:

Physics for science and engineering, part I&II.

Author: Marion and Mornyak.

Publishers: W.B. Saunders Company.

Refernce: Physics I&II.

Author: Resnick and Halliday.

Publishers: John Wiley and Sons.

**PH302**

**Electricity and Magnetism I**

**Credits 3**

1-The Electric Charge:  
Electrification, Electric Charge, Conductors and Insulators, Coulomb's law.

2-The Electric field:  
Electric field strength, Force on a point charge in an electric field, The electric dipole, lines of forces.

3-Gauss's law:  
Electric flux and electric field, Gauss's law and Coulomb's law, Applications of Gauss's law.

4-Electric Potential:  
Electric potential and electric field, Potential due to a point charge, Group of point charges and dipoles, Electric potential energy.

5-Capacitance and Dielectrics:  
Capacitance, Spherical and Parallel plate capacitors with and without Dielectric, Polarization, the displacement vector.

6-Current and Resistance:

Current and current density, Resistance, Resistivity and conductivity, Ohm's law, Energy transfers in an electric circuit.

7-Electromotive force and circuits:

Electromotive force, Single loop circuits, Potential difference, Conservation of energy, DC circuits, Kirchoff's rule, Electric measurements.

Text Book:

Physics for Science and Engineering Part II.

Author: Marion and Hornyak.

Publisher: W.B. Saunders company.

Reference: Physics part II.

Author: Resnick and Halliday.

Publishers: John Wiley and Sons.

**PH303**

**Special Theory of Relativity**

**Credits 3**

Gallelian Transformation, The Michelson-Morley experiment, Newtonian relativity.

Relativistic kinematics:

Postulates of special theory of relativity, Lorentz transformation, Length contraction and time dilation, addition theorem of velocities, Relativistic doppler's effect.

Relativistic Dynamics:

Relativistic momentum force and force acceleration relation, Variation of mass with velocity, Equivalence of mass and energy.

Relativity and Electromagnetism:

Elements of tensor analysis, Minkowski's four dimensional space, Electromagnetic field tensor and Momentum Tensor, Invariance of Maxwell's equations.

Text Book:

Introduction to Special Relativity.

Author: Robert Resnick.

Publishers: John Wiley and sons.

Reference: Theory of Relativity.

Author: Moller.

Publishers: Oxford university press.

**PH401**

**Mechanics III**

**Credits 3**

1-Motion of a particle in two and three dimensions-Central force field-Kepler's laws-Gravitational law-Motion of a particle in an electromagnetic field.  
2-Moving coordinate systems-Rotating coordinate systems-Displacement, Velocity and Acceleration in a moving coordinate system.  
3-Generalized coordinates-Lagrange's equations-Constraints constants of the motion-Electromagnetic forces and velocity dependent potentials-Lagrange's equations for vibrating systems.  
4-Hamilton's equations-Liouville's theorem-Poisons and Lagrange's Brackets-Calculus of variations-Canonical transformations-Canonical coordinates-Hamilton, Jacobi equation.  
5-Rotation of a rigid body-Inertia and stress tensors-Motion of a rigid body in space-Euler's equation of motion for a rigid body-Euler angles-The symmetric top.  
6-Theory of small vibrations-Stability conditions near an equilibrium configuration-Linearized equations of motion near an equilibrium configuration-Normal modes of vibrations-Damping perturbation theory-Small vibrations about a steady motion.

Textbook:

Mechanics.

Author: K. R. Sywon.

Publisher: Addison- Wesley Company.

Reference:

Classical Mechanics.

Author: I. W. Kibble; Publisher: McGraw Hill.

## **PH402**

## **Electricity and Magnetism II**

**Credits 3**

1-The magnetic field:

Magnetic induction vector, Magnetic flux density, Lorentz force, Magnetic forces on current carriers, Torque on a current loop, The Hall effect, Circulating charges, The Galvanometer, DC motors.

2-Ampere's law:

Ampere's law, Magnetic field near a long wire, Two parallel conductors, Magnetic field for a Solenoid, The Biot-Savart law, Gauss's law for magnetic fields.

3-Faraday's law:

Faraday's law of induction, Lenz's law motional EMF, The Maxwell's displacement current, Maxwell's field equations.

4-Inductance and Magnetic materials:

Mutual inductance, Self inductance, Coupled inductors, The magnetic field energy, Magnetic materials, The magnetic intensity vectors, Practical magnetic materials, Maxwell's equations in matter.

5-Alternating Currents:

R. C. L. elements, The resistive, Capacitive and inductive circuits, Phasor diagrams, RC, RL and LRC circuits, Power in alternating current.

6-Circuits:

Resonance, A. C. rectifiers and filters, transformers.

7-Motion of charged particles in electric and magnetic field:

$e/m$  of an electron, Mass spectrographs, Cyclotron and Betatron.

8-Electromagnetic waves:

Electromagnetic plane waves, Energy and momentum in EM. Waves, The pointing vector.

9-Radiating System:

Radiation from an accelerating charge, Electric dipole antenna, Guided waves, The waves equation.

Text Book:

Physics for Science and engineering II.

Author: Marion and Hornyak.

Publishers: W. B. Saunders company.

### **PH403**

### **Optics**

### **Credits 3**

1-Electromagnetic Theory of Light:

The fundamental laws of electromagnetism, Plane EM waves in an isotropic and homogenous medium, Theories of light, The process of reflection and refraction, Reflection and transmission, Dispersion, Scattering of light.

2-Geometrical optics:

Plane mirrors, Spherical mirrors, Refraction at spherical surfaces, Thin lenses, Fermat's principles and geometrical abbreviations, Optical instruments, The eye and vision.

3-Interference:

Conditions for interference, Interference of sinusoidal waves, Fresnel's Biprism, Lloyd's mirror, Interference of many waves, Interference by thin films, Newton's interferometer.

4-Diffraction:

Fraunhofer and Fresnel diffraction, Diffraction by a straight edge, by a single slit, Resolving power, Plane diffraction grating, Three dimensional grating.

5-Polarization:

States of polarization, Polarization by reflection and double refraction, Rotation of plane of vibration, Optical activity, Fresnel's theory, Dolameters.

Text Book:

Optics







**PH604****Nuclear Physics I****credits 3**

1- Nuclear constituents, 2- Natural radioactivity, 3-Nuclear detectors, 4- Accelerators, 5- Nuclear reactions.

Text Book:

Nuclear Physics.

Author: I. Kaplan.

Publishers: Longman group Ltd.

References:

1) Nuclear Physics by W. E. Burchan.

2) Introduction to Atomic and Nuclear Physics by H. Semat& B. R. Albright.

**PH605****Electronics I****credits 3**

1- Circuit theorems, 2- Transient circuits, 3- Sinusoidal circuits, 4- Non-sinusoidal and distributed circuits, 5- Diode and Rectifiers, 6-Vacum tubes and field effect transistor, 7-Bipolar transistors, 8-Operational amplifiers, 9- Other non linear circuits and devices.

Text Book:

Introduction to Modern Electronics.

Author: D. C. Sprout.

Publishers: John Wiley and Sons

**PH701****Quantum Mechanics I****credits 3**

1-Inadequacy of classical physics and the old quantum theory, 2-Operators, 3- Quantum mechanics, 4-One dimensional motion, 5-The Harmonic oscillator.

Text Book:

Introduction to Quantum Mechanics.

Author: P. T. Mathews.

Publishers: McGraw Hill.

Reference:

1) Quantum Mechanics by A. M. Ras.

2) Introduction to the Quantum Theory by David Park.

**PH702****Kinetic Theory and Thermodynamics****credits 3**

1- Kinetic theory, 2- Thermodynamics, 3- First law of thermodynamics, 4- Heat engines, entropy and second law of thermodynamics, 5- Pure substances, 6- Phase transition, 7- Superfluidity and superconductivity.

Text Book:  
Heat and thermodynamics.  
Author: M. W. Zemansky.  
Publishers: McGraw Hill.

**PH703                      Atomic and Molecular Physics      credits 3**

1- Extra nuclear atom, 2- Atomic spectra, 3-Atoms in magnetic fields, 4- X-Ray spectra, 5- Structure and spectra of molecules.

Text Book:  
Introduction to modern Physics.  
Author: F. K. Richtmyer, E. H. Kennard & J. N. Cooper.  
Publishers: McGraw Hill.  
Reference:  
Atomic spectra by G. Herzberg.  
Molecular spectra by G. Herzberg.

**PH704                      Nuclear Physics II      credits 3**

1- Nuclear reactions, 2- Successive disintegration, 3- Interaction of nuclear radiation with matter, 4-Nuclear decay, 5-Nuclear models, 6-Nuclear energy, 7- Elementary particles, 8- Cosmic rays.

Text Book:  
Nuclear Physics  
Author: I. Kaplan.  
Publishers: Addison Wesley pub. Co.

**PH705                      Solid State Physics I                      credits 3**

1- Atoms in crystals, 2- Waves in crystals, 3- Defects and disorder in crystals, 4- The thermal vibrations of the crystal lattice, 5- Phonons in non-metals, thermal conductivity.

Text Book:  
The solid state  
Author: H. M. Rosenberg.  
Publishers: Clarendon Press.  
Reference:  
Solid state physics.  
Author: Elliot and Gibson.  
Publishers: The Macmillan Press Ltd.

**PH801                      Quantum Mechanics II                      credits 3**

1- Angular momentum, 2-Central potential, 3-Spin and statistics, 4- Approximation methods.

Text Book:

Introduction to Quantum Mechanics.

Author: P. J. Mathews.

Publishers: McGraw Hill.

Reference:

1) Quantum Mechanics by A. J. Rew.

2) Introduction to Quantum Theory by Park.

**PH802                      Statistical Physics                      credits 3**

1-Classical and quantum distribution functions, 2-The relation of statistical mechanics to thermodynamics, 3-Applications of the Maxwell-Boltzmann distribution, 4- Applications of the Fermi-Dirac distribution, 5- Applications of the Bose-Einstein distribution.

Text Book:

An introduction to statistical physics.

Author: W. G. V. Rasser.

Publishers: John Wiley.

References:

1) Statistical Physics by F. Mandl.

1) An introduction to statistical physics for students by A. J. Pointon.

**PH803                      Solid State Physics II                      credits 3**

1- Free Electron in crystals, 2- Electrical conductivity and Band theory, 3- Semiconductors, 4- Paramagnetism, 5- Ferromagnetism, Antiferromagnetism and ferromagnetism.

Text Book:

The solid state.

Author: H. M. Rosenberg.

Publishers: Clarendon Press.

**PH805                      Electronics II                      credits 3**

1- Logic functions, 2- Integrated circuits, 3-Complex circuits, 4-Flip-flops, 5- Binary numbers and counters, 6-Clocks and projects, 7- Shift registers, 8- Digital design.

Text Book:

Applied digital electronics.

Author: Dennis M. Ward.

Publishers: Charles E. M. Pub. Company, London.

**PH807                      Bio Physics                      credits 3**

1- Mechanics, 2- Exponential growth and decay, 3- Electrical properties of nerves, 4- X-Rays, 5- Nuclear physics and nuclear medicine.

Text Book:

Intermediate physics for Medicine and Biology.

Author: Russel K. Hubble.

Publishers: John Wiley and Sons.

**PH808                                  Spectroscopy                                  credits 3**

1- Review of basic principles, 2- Electronic spectroscopy of atoms, 3- Electronic spectroscopy of diatomic molecules, 4-Masers and Lasers, 5- Nuclear magnetic resonance spectroscopy, 6- Mossbauer spectroscopy, 7- Electronic spin resonance spectroscopy.

Text Book:

Basic principles of spectroscopy.

Author: Rayman Chang.

Publishers: McGraw Hill Ltd.

**PH809                                  Solar Energy Physics                                  credits 3**

1- The sun and the earth, 2- Introduction to solar energy, 3- Collection of solar energy, 4-Heating by solar energy, 5- Conversion of solar energy into work, 6- Conversion of solar energy into electricity, 7- Photo electricity.

Text Book:

1) Solar energy.

Author; B. J. Brinkworth.

Publishers: The Compton press.

2) An introduction to solar energy for scientists and engineers.

Author: S. Weelder.

Publishers: John Wiley and Sons.

**PH810                                  Particle Physics                                  credits 3**

1-Introduction, 2- Strong interactions, 3-Electromagnetic interactions, 4-Weak interactions.

Text Book:

1) Fundamentals of elementary particles.

Author: M. J. Lorge.

2) Nuclear physics.

Author: Burcham.

Publishers: Longman group Ltd.

**PH811                                  Reactors Physics                                  credits 3**

1- Neutron physics, 2-Fission, 3- Types of reactors.

Text Book:

Introduction of Nuclear Reactors Physics.

Author: Liverhant.

**PH819**

**Graduation Research**

**credits 3**

Description

Project in which student works with a member of the physics group on current research. This project is expected to lead to a report, conference presentation, or contribution to a published paper. The student should contact an appropriate faculty member within the first two weeks of the fall semester to organize a project.