School of Physics
University of Hyderabad

Integrated M.Sc. Syllabus – July 2014

Year	Semester	Course No.	Course title	Credits
1	1	PY 101	Mechanics I	4

Contents:

Physical quantities, Units and dimensions, Scalars and Vectors, Dot and cross products, Velocity and linear momentum, Acceleration and force, Motion in one and two dimensions with constant acceleration, Projectile motion, Uniform circular motion, Newton's laws of motion and their applications, Friction, Work and energy, Conservation of energy, Rotational motion, Angular momentum and torque, Collision and conservation of momentum during collisions, Moment of inertia, Elementary dynamics of a rigid body.

Books recommended:

1. Fundamentals of Physics, Resnick, Halliday and Walker, 6^{th} edition, Wiley
2. University Physics, Sears and Zemansky, 10^{th} edition, Addison – Wesley series
3. Concepts of Physics, H.C. Verma, TMH

Year	Semester	Course No.	Course title	Credits
1	1	PY 102	Mechanics Lab	1.5

List of experiments:

1. Fly wheel
2. Cater's pendulum
3. Torsion pendulum – Disc
4. Torsion pendulum – Rod
5. Yong's modulus – Searl's method
6. Surface tension
7. Viscosity – Stoke's method
8. Bending of beam
9. Bifilar pendulum
10. Vertical oscillations of a spring with mass
11. Air track experiment

Year	Semester	Course No.	Course title	Credits
1	2	PY 151	Waves, Oscillations, Sound and Light	4

Contents:

Simple harmonic motion, Angular simple harmonic oscillator, damped harmonic oscillator, Forced oscillations and Resonance; Simple coupled oscillators.

Traveling waves, Superposition principle, Wave speed, Power and intensity in wave motion, Interference of sound waves, Stationary waves, Beats,
Waves on strings and surfaces, Audible, ultrasonic and infrasonic waves, Propagation and speed of longitudinal waves, Vibrating systems and sources of sound, Musical instruments, The Doppler effect, Shock waves,

Velocity of sound and its measurement, factors affecting the speed of sound

Nature and propagation of light, Images, Defects of images, Spherical and Chromatic aberrations, Achromatism of two thin lenses separated by a distance, Optical instruments (Microscopes and Telescopes), Velocity of light and its measurement.

Books recommended:

1. Fundamentals of Physics, Resnick, Halliday and Walker, 6th edition, Wiley
2. University Physics, Sears and Zemansky, 10th edition, Addison – Wesley series
3. Fundamentals of Optics, Jenkins and White
4. Light, K. G. Mazumdar
5. Geometrical and Physical Optics, P. K. Chakraborty
6. Optics, B. K. Mathur

Year	Semester	Course No.	Course title	Credits
1	2	PY 152	Waves, Oscillations, Sound and Light Lab	1.5

List of experiments:

1. COUPLED OSCILLATOR – Measurement of Normal Mode Frequencies
2. KUNDT'S TUBE – Determination of Velocity of Sound in Air
3. SONOMETER – Resonance Modes of a Stretched String & Velocity of Wave Propagation
4. BREWSTER ANGLE METHOD – Measurement of Refractive Index of Dielectric Material
5. FRESNEL BIPRISM – Determination of Wavelength of Light by Interference
6. NEWTON'S RINGS – Determination of Radius of Curvature of a Lens
7. FABRY – PEROT INTERFEROMETER – Measurement of Air gap Thickness
8. DIFFRACTION GRATING – Determination of Wavelengths of mercury vapor lamp.

Year	Semester	Course No.	Course title	Credits
2	3	PY 201	Electricity and Magnetism	4

Contents:

Charges and forces; Charge quantization; Coulomb's law, Electric field, Electric potential, Application of Coulomb's law to determine the potential and field due to one, two and three-dimensional charge distributions, Electric dipole and quadrupole, Gauss's theorem and its applications, Electrostatic energy

Electrostatics in a dielectric medium, Capacitors, calculation of capacitance of parallel plate, cylindrical and spherical capacitors, Capacitors in parallel and series

Moving charges and electric currents, current density, Ohm's law, Kirchhoff's law

Magnetic field, magnetic forces on a particle and current carrying conductors, Magnetic induction, Biot-Savart law, Magnetic dipole moment, Vector potential, Ampere's circuital law

Induction and inductance, Magnetic circuits, Faraday's law, Lenz's law, Self and mutual induction, Magnetic force between two circuits, LCR circuits with DC and AC sources.

Displacement current, Maxwell's equations

Books recommended:

1. Fundamentals of Physics, Resnick, Halliday and Walker, 6th edition, Wiley
2. University Physics, Sears and Zemansky, 10th edition, Addison – Wesley series
3. Introduction to electrodynamics, D.J. Griffiths, 3rd edition, Prentice Hall
4. Electricity and magnetism, A.S. Mahajan and A. A. Rangwala, McGraw Hill
5. Marion

Year	Semester	Course No.	Course title	Credits
1	3	PY 202	Electricity and Magnetism Lab	1.5

List of experiments:

1. Charging and Discharging a Capacitor
2. Resonance in LCR Circuits
3. Electromagnetic Induction
4. Measurement of Average Resistance of a Wire by Carey-Foster method and to determine the value of unknown resistance
5. Comparison of E.M.F.'s of Two Cells with the Help of Potentiometer
6. Measurement of E.M.F. of a Cell by Potentiometer, Using a Milli-ammeter
7. Hysteresis Curve
8. Determination of the Moment of a Bar Magnet and the Horizontal Component of Earth's Magnetic Field by Magnetometers
9. Kelvin Double Bridge for Measuring Very Low Resistance

Year	Semester	Course No.	Course title	Credits
2	4	PY 251	Advent of Quantum Theory and Special Relativity	4

Contents:

Inertial frame, Galilean covariance of Newton's second law, Inconsistency with electromagnetic theory, Michelson-Morley experiment, Interpretation of null results of Michelson-Morley experiment, Postulates of special theory of Relativity, Definition of interval, Minkowski space-time diagram, Lorentz transformation in (1+1) and (3+1) dimension for standard configuration, Relativity of simultaneity, Length contraction and time dilation and their consequences, Transformation of velocity and acceleration, Fizeau's experiment, Four vectors, Relativistic dynamics, Equivalence of mass and energy.

Millikan's oil-drop experiment. Thomson's model of the atom, Rutherford's experiment on scattering of alpha particles, Rutherford's scattering formula, Rutherford's model of the atom.

Inadequacies of classical physics, The Blackbody radiation and Planck's hypothesis, The photoelectric effect, The Compton effect, Bohr's theory of hydrogen atom, Sommerfeld's modification, Quantum numbers, Wave particle duality, Davisson and Germer's electron diffraction experiment, G. P. Thomson's experiments, Uncertainty principle, Heisenberg microscope.

Dynamical variables and operators, Position and momentum operators, Fundamental commutation relation, Wave function and its probabilistic interpretation, Coordinate representation, Time-dependent Schrodinger equation, Probability current and conservation of probability, Time-independent Schrodinger equation, Stationary states, Expectation values, Free particle problem, Particle in a box.

Books recommended:

1) Concepts of Modern Physics, Arthur Beiser, McGraw Hill edition
2) Introduction to Modern Physics, H.S. Mani and G.K. Mehta, Affiliated East-West

Year	Semester	Course No.	Course title	Credits
1	4	PY 252	Heat and Thermodynamics Lab	1.5

List of experiments:

1. Gas laws: Boyles law
2. Gas laws: Charles law
3. Constant volume gas thermometer
4. Electric Joule heating
5. Seebeck effect and thermocouple
6. Thermal conductivity of a poor conductor (Lees method)
7. Thermal conductivity of a good conductor (Searles method)
8. Specific heat capacity – Method of mixtures
9. Phase change – Latent heat
10. Stefan-Boltzmann law