B. Sc.- Semester I

MECHANICS AND WAVE MOTION

(4 CREDITS) PAPER I (40 LECTURES)

Unit I

Inertial and non-inertial reference frames, radial and transverse components of velocity and acceleration using polar coordinates, Newton's laws of motion. Dynamics of particle in rectilinear and circular motion, Conservative and Non-Conservative forces, conservation of energy, linear momentum, and angular momentum. Collision in one and two dimensions, cross section.

Unit II

Rotational energy and rotational inertia for simple bodies (ring, disk, rod, solid and hollow sphere, cylinder, rectangular lamina). The combined translational and rotational motion of a rigid body on horizontal and inclined planes. Simple treatment of the motion of a top. Relations between elastic constants, bending of beam and torsion of cylinder.

Unit III

Central forces, Two body central force problem, Reduced mass and its equation of motion, Centre of mass motion, Newton's law of gravitation; Gravitational binding energy, Equivalence of inertial and gravitational mass, Gravitational field and potential at a point inside and outside a hollow and solid sphere. Kepler's laws, motion of planets and satellites, geo-stationary satellites.

Unit IV

Differential equation of Simple Harmonic Motion (SHM) and its solution, use of complex notation, damped and forced oscillations, Quality factor. Composition of simple harmonic motion, Lissajous figures.

Differential equation of wave motion, plane progressive waves in fluid media, reflection of waves, phase change on reflection, Principle of superposition of waves, stationary waves, pressure and energy distribution, phase and group velocity.

B. Sc.- Semester I

CIRCUIT FUNDAMENTALS AND BASIC ELECTRONICS

(4 CREDITS) PAPER II (40 LECTURES)

Unit I

Growth and decay of current through inductive resistances (LR circuit), charging and discharging of capacitor through resistance (CR circuit) and inductive resistance (LCR circuit) , time constant, Measurement of high resistance by leakage method.

Alternating current in RLC circuits, method of imaginaries, complex impedance, phase diagrams, Q factor, series and parallel resonant circuits, theory of coupled circuits, Transformers, Reflected Impedance and impedance matching, Maximum power transfer theorem. AC bridges: Maxwell, Schering and Wien.

Unit II

Semiconductors: Covalent bonding, Energy bands, Forbidden energy gap, Intrinsic and extrinsic semiconductors, p-type and n-type semiconductors. Formation of the pn junction. Depletion layer, Field and potential at the depletion layer. Unbiased diode, Forward and Reverse biased diodes, Current conduction in a pn junction, majority and minority carriers. Characteristic curves. Static (DC) and Dynamic (AC) resistance.Diode as a rectifier, Half wave, Full wave and Bridge rectifier. Rectification Efficiency and Ripple factor. Zener and Avalanche breakdown. Zener diode as a voltage regulator. Filter Circuits: Choke input filter, Capacitor input filter, L and π type filters; DC Power supply, Bipolar transistors: PNP and NPN transistors, their characteristic curves in common base, common emitter and common collector configurations, Active, Cut-off and Saturation regions, DC alpha and DC beta and relationship between them.

Unit III

Transistor biasing: Need for biasing, Transistor biasing circuits: Base Bias, Emitter Bias, Voltage Divider Bias. Transistor leakage currents, thermal runaway, transistor stabilization, swamping, Stability factor. Load line, DC and AC load line, Operating point. DC and AC equivalent circuits. Low frequency transistor models, small signal amplifiers, Common Base, Common Emitter, Common Collector amplifier, Current and Voltage gain, RC coupled amplifier, Qualitative treatment, Study of frequency response of RC coupled amplifier.

Unit IV

Feedback in amplifiers: Positive and Negative feedback, Input and Output Impedance of Negative feedback voltage amplifiers. Transistor as an oscillator, Tank circuit, Barkhausen criterion, General discussion and theory of Hartley oscillator. Elements of transmission and reception, Basic principle of amplitude modulation and demodulation, principle and design of linear multimeters and their applications, Cathode ray Oscilloscope and its simple applications.