

**B.Sc. (Physics) Semester I-Theory Syllabus  
Paper – I: Mechanics**

**56 hrs**

**(w. e. from academic year 2019-20)  
(CBCS)**

**Unit – I**

**1. Vector Analysis (14)**

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field and related problems. Vector integration, line, surface and volume integrals. Stokes, Gauss and Greens theorems- simple applications.

**Unit – II**

**2. Mechanics of Particles (07)**

Laws of motion, motion of variable mass system, motion of a rocket, multi-stage rocket, conservation of energy and momentum. Collisions in two and three dimensions, concept of impact parameter, scattering cross-section.

**3. Mechanics of rigid bodies (07)**

Definition of Rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertial tensor. Euler's equation, precession of a top, Gyroscope.

**Unit – III**

**4. Central forces (14)**


Central forces – definition and examples, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force, gravitational potential and gravitational field, motion under inverse square law, derivation of Kepler's laws, Coriolis force and its expressions.

**Unit – IV**

**5. Special theory of relativity (14)**

Galilean relativity, absolute frames, Michelson-Morley experiment, Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation. Concept of four vector formalism.

**NOTE:** Problems should be solved at the end of every chapter of all units.

  
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### Textbooks

1. Berkeley Physics Course. Vol.1, **Mechanics** by C. Kittel, W. Knight, M.A. Ruderman - *Tata-McGraw hill Company Edition 2008.*
2. **Fundamentals of Physics.** Halliday/Resnick/Walker *Wiley India Edition 2007.*
3. **First Year Physics - Telugu Academy.**
4. **Introduction to Physics for Scientists and Engineers.** F.J. Ruche. *McGraw Hill.*
5. **Sears and Zemansky's University Physics** by Hugh D. Young, Roger A. Freedman *Pearson Education Eleventh Edition.*
6. **Theory of relativity - Resnick**

### Reference Books

1. **Fundamentals of Physics** by Alan Giambattista et al *Tata-McGraw Hill Company Edition, 2008.*
2. **University Physics** by Young and Freeman, *Pearson Education, Edition 2005.*
3. **An introduction to Mechanics** by Daniel Kleppner & Robert Kolenkow. *The McGraw Hill Companies.*
4. **Mechanics.** Hans & Puri. *TMH Publications.*

  
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## Question paper pattern

### FIRST SEMESTER PRACTICALS

36 hrs  
(3 hrs / week)

### Practical Paper – I : Mechanics

1. Study of a compound pendulum determination of 'g' and 'k'.
2. Y' by uniform Bending
3. Y by Non-uniform Bending.
4. Moment of Inertia of a fly wheel.
5. Measurement of errors –simple Pendulum.
6. 'Rigidity moduli by torsion Pendulum.
7. Determine surface tension of a liquid through capillary rise method.
8. Determination of Surface Tension of a liquid by different methods.
9. Determine of Viscosity of a fluid.
10. Calculation of slope and intercept of a  $Y = mX + C$  by theoretical method

**Note:** Minimum of eight experiments should be performed. Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

### **Text and reference books**

1. D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).
2. S.P. Singh, "Advanced Practical Physics" (PragatiPrakashan, Meerut).
3. "Practical Physics" R.K Shukla, AnchalSrivastava

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**Subject: Physics**

**B.Sc. Semester II-Theory Syllabus  
Paper – II : Thermal Physics  
(W.E.F the academic year 2019-2020)**

**56 hrs**

**Unit – I**

**1. Kinetic theory of gases: (6)**

Introduction – Deduction of Maxwell's law of distribution of molecular speeds, Transport Phenomena – Viscosity of gases – thermal conductivity – diffusion of gases.

**2. Thermodynamics: (8)**

Basics of thermodynamics-Kelvin's and Clausius statements – Thermodynamic scale of temperature – Entropy, physical significance – Change in entropy in reversible and irreversible processes – Entropy and disorder – Entropy of universe – Temperature-Entropy (T-S) diagram – Change of entropy of a perfect gas-change of entropy when ice changes into steam.

**Unit – II**

**3. Thermodynamic potentials and Maxwell's equations: (7)**

Thermodynamic potentials – Derivation of Maxwell's thermodynamic relations – Clausius-Clayperon's equation – Derivation for ratio of specific heats – Derivation for difference of two specific heats for perfect gas. Joule Kelvin effect – expression for Joule Kelvin coefficient for perfect and Vanderwaal's gas.

**4. Low temperature Physics: (7)**

Joule Kelvin effect – liquefaction of gas using porous plug experiment. Joule expansion – Distinction between adiabatic and Joule Thomson expansion – Expression for Joule Thomson cooling – Liquefaction of helium, Kapitza's method – Adiabatic demagnetization – Production of low temperatures – Principle of refrigeration, vapour compression type.

**Unit – III**

**5. Quantum theory of radiation: (14)**

Black body-Ferry's black body – distribution of energy in the spectrum of Black body – Wein's displacement law, Wein's law, Rayleigh-Jean's law – Quantum theory of

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radiation - Planck's law – deduction of Wein's distribution law, Rayleigh-Jeans law, Stefan's law from Planck's law.

Measurement of radiation using pyrometers – Disappearing filament optical pyrometer – experimental determination – Angstrom pyroheliometer - determination of solar constant, effective temperature of sun.

## Unit – IV

### 6. Statistical Mechanics: (14)

Introduction, postulates of statistical mechanics. Phase space, concept of ensembles and some known ensembles, classical and quantum statistics and their differences, concept of probability, Maxwell-Boltzmann's distribution law -Molecular energies in an ideal gas- Maxwell-Boltzmann's velocity distribution law, Bose-Einstein Distribution law, Fermi-Dirac Distribution law, comparison of three distribution laws, Application of B-E distribution to Photons-plank's radiation formula, Application of Fermi-Dirac statistics to white dwarfs and Neutron stars.

#### Textbooks

1. **Fundamentals of Physics.** Halliday/Resnick/Walker.C. *Wiley India Edition 2007.*
2. **Second Year Physics – Telugu Academy.**
3. **Modern Physics** by R. Murugesan and Kiruthiga Siva Prasath (for statistical Mechanics) *S. Chand & Co.*
4. **Heat and Thermodynamics** by Mark W.Zemansky 5<sup>th</sup> edition McGraw - Hill
5. **Heat and Thermodynamics** by D.S. Mathur.

#### Reference Books

1. **Modern Physics** by G. Aruldas and P. Rajagopal, *Eastern Economy Education.*
2. B.B. Laud "Introduction to statistics Mechanics"(Macmillan 1981)
3. F.Reif: "Statistical Physics "(Mcgraw-Hill,1998)
4. K.Haug: "Statistical Physics "(Wiley Eastern 1988)

*M. V. S. Narayana*  
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## II SEMESTER Practicals Paper – II :

42 hrs  
(3 hrs / week)

### Thermal Physics

1. Co-efficient of thermal conductivity of a bad conductor by Lee's method.
2. Measurement of Stefan's constant.
3. Specific heat of a liquid by applying Newton's law of cooling correction.
4. Heating efficiency of electrical kettle with varying voltages.
5. Determination of Thermo emf
6. Cooling Curve of a metallic body (Null method)
7. Resistance thermometer. To Determine temp coeff resistance
8. Thermal expansion of solids
9. Study of conversion of mechanical energy into heat.
10. Determine the Specific of a solid (graphite rod )
11. Thermistor Characteristics. Calculation of A and B

**Note:** Minimum of eight experiments should be performed. Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

### **Text and reference books**

1. D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).
2. S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).
3. Worsnop and Flint- Advanced Practical physics for students.
4. "Practical Physics" R.K Shukla, Anchal Srivastava

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**PAPER – III: ELECTROMAGNETIC THEORY**

<b>Theory:</b>	<b>4 Hours/Week;</b>	<b>Credits: 4</b>	<b>Marks: 100 (Internal: 20; External: 80)</b>
<b>Practical:</b>	<b>3 Hours/Week</b>	<b>Credits: 1</b>	<b>Marks: 25</b>

**UNIT I**

**Electrostatics**

Electric Field:- Concept of electric field lines and electric flux, Gauss's law (Integral and differential forms), application to linear, plane and spherical charge distributions, Conservative nature of electric field 'E', Irrotational field. Electric potential: Concept of electric potential, relation between electric potential and electric field, potential energy of a system of charges, Energy density in an electric field, Calculation of potential from electric field for a spherical charge distribution.

**UNIT II**

**Magnetostatics**

Concept of magnetic field 'B' and magnetic flux, Biot-Savart's law, 'B' due to a straight current carrying conductor, Force on a point charge in a magnetic field, Properties of B, curl and divergence of B, solenoidal field, Integral form of Ampere's law, Applications of Ampere's law: field due to straight, circular and solenoidal currents. Energy stored in magnetic field. Magnetic energy in terms of current and inductance, Magnetic force between two current carrying conductors, Magnetic field intensity, Ballistic Galvanometer: Torque on a current loop in a uniform magnetic field, working principle of B.G., current and charge sensitivity, electromagnetic damping, critical damping resistance.

**UNIT III:**

**Electromagnetic Induction and Electromagnetic waves**

Faraday's laws of induction (differential and integral form), Lenz's law, self and mutual Induction, Continuity equation, modification of Ampere's law, displacement current, Maxwell equations, Maxwell's equations in vacuum and dielectric medium, boundary conditions, plane wave equation: transverse nature of EM waves, velocity of light in vacuum and in medium, Poynting's theorem.

**UNIT IV:**

**Varying and alternating currents**

Growth and decay of currents in LR, CR and LCR circuits - Critical damping, Alternating current, relation between current and voltage in pure R, C and L-vector diagrams - Power in ac circuits. LCR series and parallel resonant circuit-Q-factor, AC & DC motors-single phase, three phase (basics only).

**Network Theorems**

Passive elements, Power sources, Active elements, Network models: T and  $\pi$  Transformations, Superposition theorem, Thevenin's theorem, Norton's theorem. Reciprocity theorem and Maximum power transfer theorem (Simple problems).

**Suggested Books:**

1. Fundamentals of electricity and magnetism By Arthur F. Kip (McGraw-Hill, 1968)
2. Electricity and magnetism by J. H. Fewkes & John Yarwood. Vol. I (Oxford Univ. Press, 1991).
3. Introduction to Electrodynamics, 3rd edition, by David J. Griffiths, (Benjamin Cummings, 1998).
4. Electricity and magnetism By Edward M. Purcell (McGraw-Hill Education, 1986)
5. Electricity and magnetism. By D C Tayal (Himalaya Publishing House, 1988)
6. Electromagnetics by Joseph A. Edminister 2nd ed. (New Delhi: Tata McGraw Hill, 2006).





**PAPER – III: ELECTROMAGNETIC THEORY  
PRACTICALS**

1. To verify the Thevenin's Theorem
2. To verify Norton Theorem
3. To verify Superposition Theorem
4. To verify maximum power transfer theorem.
5. To determine a small resistance by Carey Foster's bridge.
6. To determine the (a) current sensitivity, (b) charge sensitivity, and (c) CDR of a B.G.
7. To determine high resistance by leakage method.
8. To determine the ratio of two capacitances by De Sauty's bridge.
9. To determine self-inductance of a coil by Anderson's bridge using AC.
10. To determine self-inductance of a coil by Rayleigh's method.
11. To determine coefficient of Mutual inductance by absolute method.

**Note:** Minimum of eight experiments should be performed.

Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

**Suggested Books:**

1. B. L. Worsnop and H. T. Flint Advanced Practical Physics, Asia Publishing House, New Delhi.
2. Indu Prakash and Ramakrishna, A Text Book of Practical Physics, Kitab Mahal





PAPER – IV:: WAVES AND OPTICS

Theory:	4 Hours/Week;	Credits: 4	Marks: 100 (Internal: 20; External: 80)
Practical:	3 Hours/Week	Credits: 1	Marks: 25

**UNIT-I:**

**Waves**

Fundamentals of Waves -Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones, energy transport, transverse impedance.

Longitudinal vibrations in bars- wave equation and its general solution, Special cases: (i) bar fixed at both ends, ii) bar fixed at the midpoint, iii) bar free at both ends, iv) bar fixed at one end, Transverse vibrations in a bar - wave equation and its general solution. Boundary conditions, clamped free bar, free-free bar, bar supported at both ends, Tuning fork.

**UNIT II:**

**Interference**

Principle of superposition – coherence – temporal coherence and spatial coherence – conditions for Interference of light.

Interference by division of wave front: Fresnel's biprism – determination of wave length of light. Determination of thickness of a transparent material using biprism – change of phase on reflection – Lloyd's mirror experiment.

Interference by division of amplitude: Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (Cosine law) – Colours of thin films – Non-reflecting films – interference by a plane parallel film illuminated by a point source – Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film) – Determination of diameter of wire-Newton's rings in reflected light with and without contact between lens and glass plate, Newton's rings in transmitted light (Haidinger Fringes) – Determination of wave length of monochromatic light – Michelson Interferometer – types of fringes – Determination of wavelength of monochromatic light, Difference in wavelength of sodium  $D_1, D_2$  lines and thickness of a thin transparent plate.

**UNIT III:**

**Diffraction:**

Introduction – Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction:- Diffraction due to single slit and circular aperture – Limit of resolution – Fraunhofer diffraction due to double slit – Fraunhofer diffraction pattern with N slits (diffraction grating).

Resolving Power of grating – Determination of wave length of light in normal and oblique incidence methods using diffraction grating.

Fresnel diffraction-Fresnel's half period zones – area of the half period zones –zone plate – Comparison of zone plate with convex lens – Phase reversal zone plate – diffraction at a straight edge – difference between interference and diffraction.





## UNIT IV:

### Polarization

Polarized light : Methods of Polarization, Polarization by reflection, refraction, Double refraction, selective absorption , scattering of light – Brewster’s law – Malus law – Nicol prism polarizer and analyzer – Refraction of plane wave incident on negative and positive crystals (Huygen’s explanation) – Quarter wave plate, Half wave plate – Babinet’s compensator – Optical activity, analysis of light by Laurent’s half shade polarimeter.

*NOTE: Problems should be solved at the end of every chapter of all units.*

### Suggested books

1. **Optics** by AjoyGhatak. *The McGraw-Hill companies.*
2. **Optics** by Subramaniyam and Brijlal. *S. Chand & Co.*
3. **Fundamentals of Physics.** Halliday/Resnick/Walker.C. *Wiley India Edition 2007.*
4. **Optics and Spectroscopy.** R. Murugesan and Kiruthiga Siva Prasath. *S. Chand & Co.*
5. **Second Year Physics – Telugu Academy.**
1. **Modern Engineering Physics** by A.S. Vasudeva. *S.Chand & Co. Publications.*
2. **Feyman’s Lectures on Physics** Vol. 1, 2, 3 & 4. *Narosa Publications.*
3. **Fundamentals of Optics** by Jenkins A. Francis and White E. Harvey, *McGraw Hill Inc.*
4. K. Ghatak, **Physical Optics’**
5. D.P. Khandelwal, **Optical and Atomic Physics’** (Himalaya Publishing House, Bombay,1988)
11. Jenkins and White: **‘Fundamental of Optics’** (McGraw-Hill)
12. Smith and Thomson: **‘Optics’** (John Wiley and sons).

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PAPER – IV:: WAVES AND OPTICS  
PRACTICALS

1. Thickness of a wire using wedge method.
2. Determination of wavelength of light using Biprism.
3. Determination of Radius of curvature of a given convex lens by forming Newton's rings.
4. Resolving power of grating.
5. Study of optical rotation- polarimeter.
6. Dispersive power of a prism
7. Determination of wavelength of light using diffraction grating minimum deviation method.
8. Wavelength of light using diffraction grating – normal incidence method.
9. Resolving power of a telescope.
10. Refractive index of a liquid and glass (Boys Method).
11. Pulfrich refractometer – determination of refractive index of liquid.
12. Wavelength of Laser light using diffraction grating.
13. Verification of Laws of a stretched string (Three Laws).
14. Velocity of Transverse wave along a stretched string
15. Determination of frequency of a bar- Melde's experiment

*Note: Minimum of eight experiments should be performed Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.*

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2. S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).
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