(Applicable to the batch of students admitted in the academic year 2025-26 onwards)

B.Sc. Physics (CBCS) :: DEPARTMENT OF PHYSICS :: FACULTY OF SCIENCE, SU

B.Sc. (PHYSICS)

Syllabus (CBCS)

(w.e.f. 2025-2026)

FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS
SATAVAHANA UNIVERSITY
KARIMNAGAR – 505002

2025-2026

B.Sc. (Physics) - I Year
Semester – I
Paper – I: Mechanics and Oscillations

Unit – I

Vector Analysis (5)
Scalar and Vector fields, Gradient of a Scalar field, Divergence and Curl of a Vector field and their physical significance and related problems. Vector integration, line, surface and volume integrals. Applications of Stokes', Gauss's and Green's theorems.

Mechanics of Particles and Rigid Bodies(7)
Laws of motion, motion of variable mass system, motion of a rocket, multi-stage rocket, parts of a rocket and their functions. 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 – II

Central Forces (7)
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.

Special theory of Relativity (7)
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.

Unit – III

Oscillations(10)
Simple harmonic oscillator, and solution of the differential equation– Physical characteristics of SHM, torsion pendulum measurements of rigidity modulus, compound pendulum, measurement of g. Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance, velocity resonance.

Unit – IV

Waves(12)
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 mid point iii) bar free at both ends iv) bar fixed at one end. Transverse vibrations in a bar - wave equation and its general solution.

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

Reference books:

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**

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

B.Sc. (Physics)- I Year
Semester – I
Paper – I: Mechanics and Oscillations practicals

1. Measurement of errors –simple Pendulum.
2. Calculation of slope and intercept of a Y= mX +C graph by theoretical method (simple pendulum experiment)
3. Study of a compound pendulum- determination of 'g' and 'k'.
4. Moment of Inertia of a fly wheel.
5. Rigidity moduli by torsion Pendulum.
6. Determine surface tension of a liquid through capillary rise method.
7. Determination of Surface Tension of a liquid by any other method.
8. Determine of Viscosity of a fluid.
9. Study of oscillations of a mass under different combination of springs-Series and parallel
10. Study of Oscillations under Bifilar suspension-Verification of axis theorems.
11. Verification of Laws of a stretched string (Three Laws).
12. Velocity of Transverse wave along a stretched string
13. Determination of frequency of a bar-Melde's experiment
14. Verification of Stokes, Gauss-Divergence and Green's theorem using simulation.
15. Experimental analysis of gyroscope using simulation.

***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.*

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.

B.Sc. (Physics)- 1 Year
Semester - II
Paper - II: Thermal Physics

Unit - I

Kinetic theory of gases: (3)

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

Thermodynamics: (7)

Basics of Thermodynamics- Carnot's engine (qualitative)-Carnot's theorem -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. Application of entropy in waste management.

Unit - II

Thermodynamic potentials and Maxwell's equations: (6)

Thermodynamic potentials - Derivation of Maxwell's thermodynamic relations - Clausius-Clapeyron's equation - Derivation for ratio of specific heats - Derivation for difference of two specific heats for perfect gas.

Low temperature Physics: (8)

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, Thermocouple- seebeck effect, Peltier effect and Thomson's effect.

Unit - III

Quantum theory of radiation: (12)

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 radiation - Planck's law - deduction of Wein's law, Rayleigh-Jeans law, Stefan's law from Planck's law. Measurement of radiation using pyrometers - Disappearing filament optical pyrometer - experimental determination - Angstrom pyro heliometer - determination of solar constant, effective temperature of sun.

Unit - IV

Statistical Mechanics: (12)

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 (qualitative), Bose-Einstein Distribution law- application to Photon energy, Fermi-Dirac Distribution law- free electron gas, comparison of three distribution laws.

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

Suggested books:

1. Fundamentals of Physics. Halliday / Resnick/Walker.C. Wiley India Edition 2007
2. Second Year Physics- Telugu Academy.
3. Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath (For statistical Mechanics) S. Chand & co.
4. Modern Physics by G. Aruldas and P. Rajagopal, Eastern Economy Education.
5. Berkeley Physics Course. Volume-5. Statistical Physics by F. Reif. The McGraw-Hill companies.
6. An Introduction to Thermal Physics by Daniel V. Schroeder. Pearson Education Low Price Edition.
7. Thermodynamics by R. C. Srivastava, Subit K. Saha & Abhay K. Jain Eastern Economy Edition.
8. Modern Engineering Physics by A.S. Vasudeva. S. Chand & Co. Publications.
9. B.B. Laud "Introduction to statistical Mechanics" (Macmillan 1981).

B.Sc. (Physics) – I year
Semester - II
Paper – II: Thermal Physics Practicals

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. Calibration of thermo couple
6. Cooling Curve of a metallic body
7. Resistance thermometer
8. Thermal expansion of solids
9. Study of conversion of mechanical energy to heat.
10. Determine the Specific heat of a solid (graphite rod)
11. Simulations for T-S doiagram

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