

KAKATIYA UNIVERSITY-WARANGAL-TELANGANA

Under Graduate Courses (Under CBCS 2025–2026 onwards)

B.Sc (PHYSICS) - I Year, SEMESTER – I

Paper–I: Mechanics and Oscillations

w.e.f academic year (2025-26) (CBCS)

Total: 56 Hrs (4hrs/week)

UNIT–I

Vector Analysis: (7 hrs)

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.

Rigid body Dynamics: (7 hrs)

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

UNIT–II

Central Forces: (7 hrs)

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 hrs)

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

UNIT – III

Oscillations: (14 hrs)

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: (14 hrs)

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.


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

Reference/Suggested Books

- 1) **Mechanics** by C.Kittel,W.Knight,M.A.Ruderman-Berkeley Physics Course.Vol.1, *Tata-Mc Grawhill Company Edition2008.*
- 2) **Fundamentals of Physics.**Halliday/Resnick/Walker *Wiley India Edition2007.*
- 3) **Theory of relativity - Resnick**
- 4) **First Year Physics-Telugu Academy, Telangana**
- 5) **Introduction to Physics for Scientists and Engineers.** F.J. Ruche. *McGraw Hill.*
- 6) **Fundamentals of Physics** by Alan Giambattistaetal *Tata-Mc Graw Hill Company*
Edition, 2008.
- 7) **University Physics** byYoung and Freeman,*Pearson Education, Edition2005.*
- 8) **Sears and Zemansky's University Physics** by Hugh D.Young, Roger A.Freedman
Pearson Education Eleventh Edition.
- 9) **An introduction to Mechanics** by Daniel Kleppner & Robert Kolenkow. *The McGraw Hill Companies.*
- 10) **Mechanics** by Hans & Puri. *TMH Publications.*
- 11) **Engineering Physics.** R.K.Gaur & S.L. Gupta. *Dhanpat Rai Publications.*
- 12) **The Feynman Lectures in Physics, Vol.-1,** R P Feynman, R B Lighton and MSands,
BI Publications,
- 13) **Mechanics** by P.K.Srivastava-NewAge International.
- 14) **Mathematical Physics** by SatyaPrakash- Sultan Chand & Sons.
- 15) **Vector Analysis** by Murray R.Spiegel-2nd edition-Schaum's Outlines,Mc GrawHill
Education


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B.Sc (Physics) -I year, Semester - I
Paper-I: Mechanics & Oscillations Practical lab

No. of hours per week: 2

- 1) Simple pendulum – Measurement of errors
- 2) Study of a compound pendulum-determination of 'g' and 'k'.
- 3) Determination of Young modulus by uniform bending of a wooden/ metal bar method.
- 4) Determination of moment of inertia of a flywheel.
- 5) Determination of rigidity modulus by torsion pendulum.
- 6) Determine of Viscosity of a fluid by poissuele method.
- 7) Determination of oscillations of a given spring constant and frequency by using combination of springs-series and parallel.
- 8) Study of Oscillations under bifilar suspension-Verification of axis theorems.
- 9) Determine surface tension of a liquid through capillary rise method.
- 10) Determine surface tension of a liquid by any other method.
- 11) Verification of laws of a stretched string using Sonometer. (Three Laws).
- 12) Calculation of slope and intercept of a $Y = mX + C$ graph by theoretical method (simple pendulum experiment)
- 13) Determination of frequency of a Bar-Melde's experiment
- 14) Experimental analysis of gyroscope using simulation.
- 15) Verification of Stokes, Gauss-Divergence and Green's theorem 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.

Suggested Books

- 1) D.P.Khandelwal, "A laboratory manual for under graduate 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.KShukla, Anchal Srivastava.


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