



# Telangana University

## Syllabus of Bachelor of Science (B.Sc) Physics - I year

### Mechanics and Waves and Oscillations 120 hrs (4 hrs/week)

#### Unit – I 30 hrs

##### 1. Vector Analysis (10)

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 Green's theorems- simple applications.

##### 2. Mechanics of Particles (10)

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, Rutherford scattering.

##### 3. Mechanics of rigid bodies (10)

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, precession of the equinoxes

#### Unit – II 30 hrs

##### 4. Mechanics of continuous media (8)

Elastic constants of isotropic solids and their relation, Poisson's ratio and expression for Poisson's ratio in terms of  $\nu$ ,  $n$ ,  $k$ . Classification of beams, types of bending, point load, distributed load, shearing force and bending moment, sign conventions, simple supported beam carrying a concentrated load at mid span, cantilever with an end load

##### 5. Central forces (12)

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.

##### 6. Special theory of relativity (10)

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 30 hrs

##### 7. Fundamentals of vibrations (12)

Simple harmonic oscillator, and solution of the differential equation– Physical characteristics of SHM, compound pendulum, measurement of 'g', torsion pendulum, - measurements of rigidity modulus. Combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies, Lissajous figures

##### 8. Damped and forced oscillations (12)

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with undamped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance, velocity resonance

#### 9. Complex vibrations (6)

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw-tooth wave

### **Unit – IV 30 hrs**

#### 10. Vibrations of bars (12)

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. Boundary conditions, clamped free bar, free-free bar, bar supported at both ends, Tuning fork.

#### 11. Vibrating Strings (12)

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

#### 12. Ultrasonics (6)

Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics, determination of wavelength of ultrasonic waves. Velocity of ultrasonics in liquids by Sear's method. Applications of ultrasonic waves.

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

### **Text 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 and Walker Wiley India Edition 2007.
3. Waves and Oscillations. S. Badami, V. Balasubramanian and K. Rama Reddy Orient Longman.
4. First Year Physics - Telugu Academy.
5. Mechanics of Particles, Waves and Oscillations. Anwar Kamal, New Age International.
6. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
7. Introduction to Physics for Scientists and Engineers. F.J. Ruche. McGraw Hill.
8. Waves and Oscillations. N. Subramaniam and Brijlal Vikas Publishing House Private Limited.

### **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. Sears and Zemansky's University Physics by Hugh D. Young, Roger A. Freedman Pearson Education Eleventh Edition.
4. An introduction to Mechanics by Daniel Kleppner & Robert Kolenkow. The McGraw Hill Companies.
5. Mechanics. Hans & Puri. TMH Publications.
6. Engineering Physics. R.K. Gaur & S.L. Gupta. Dhanpat Rai Publications.

# Bachelor of Science (B.Sc) Physics – I Year

## Mechanics and Waves and Oscillations

### PRACTICALS

1. Study of a compound pendulum determination of 'g' and 'k'.
2. Study of damping of an oscillating disc in Air and Water logarithmic decrement.
3. Study of Oscillations under Bifilar suspension.
4. Study of oscillations of a mass under different combination of springs.
5. 'Y' by uniform Bending (or) Non-uniform Bending.
6. Verification of Laws of a stretched string (Three Laws) - Sonometer
7. Moment of Inertia of a fly wheel.
8. Measurement of errors – Simple Pendulum.
9. Determination of frequency of a Bar - Melde's experiment.
10. 'n' by torsion pendulum.
11. Observation of Lissajous figures from CRO.
12. Study of flow of liquids through capillaries.
13. Determination of Surface Tension of a liquid by different methods.
14. Study of Viscosity of a fluid by different methods.
15. Volume Resonator –determination of frequency of a tuning fork.

**Note: Any twelve of the experiments are to be performed.**