

Syllabus Prescribed for B.Sc. I Year UG Programme

Programme:

Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
PHY/SICS	Mechanics, Properties of matters, Oscillations & Relativity	72

COs

On successful completion of this course, the students would be able to

1. Discuss the basic concepts of rotational dynamics.
2. Examine the phenomenon of simple harmonic motion and distinction between undamped, damped and forced oscillations and the concept of resonance.
3. Explain the superposition of simple harmonic motion and acquire the knowledge of Ultrasonic waves, their production, detection and applications in different field.
4. Determine the constants of elasticity and relate it with appropriate things
5. Interpret the postulates of special theory of relativity.
6. Know the concept of Global positioning system (GPS)

Unit	Content
Unit I	Rotational Dynamics: Rigid body, Torque, Rotation about fixed axis, Kinetic Energy of rotation, moment of inertia and its physical significance, Radius of gyration, Perpendicular and parallel axes theorem (Statement Only), Fly-wheel, Moment of inertia of different bodies (Rod, Disc, cylinder and sphere) about different axes, Rolling motion. Principle of Conservation of Angular momentum. Principle and working of Gyroscope. Numericals 12 (periods)
Unit II	SHM and its solution, time period of simple pendulum, compound pendulum, kater's pendulum & Torsional pendulum; Bifilar pendulum (Qualitative). Damped Oscillations: Differential equation of damped harmonic oscillator and its solution, Energy equation of damped oscillations, Power dissipation and Quality factor. Forced Oscillations: Differential equation of forced oscillation (Qualitative), Resonance (Amplitude). Numericals 12 (periods)
Unit III	Superposition of S.H.Ms.: Superposition of two SHM of same frequency along the same line, superposition of two mutually perpendicular SHM of same frequency, Lissajous figures. Velocity of longitudinal waves (Newton's formula), Laplace correction, velocity of transverse waves in stretched string, Standing waves, Organ Pipe, harmonics and overtones. Velocity of waves by Kundt's tube. Ultrasonic waves: Production (piezoelectric crystal and Magnetostriction) and detection of ultrasonic waves and its applications in medical and industrial field. Numericals 12 (periods)
Unit IV	Elasticity: Different types of elasticity, Twisting couple on a cylindrical rod or wire, Determination of modulus of rigidity by Maxwell needle, Torsional pendulum, Torsional oscillations, Modulus of rigidity of a material of wire by torsional pendulum, Beam, Bending of beam, Bending moment, External and internal bending moments, Cantilever, Expression for depression of a beam (i) loaded at one end and (ii) loaded at the center. Numericals 12 (periods)
Unit V	Gravitation and Special Theory of Relativity: Kepler's laws of planetary motion (Statements only), Newton's law of gravitation, Variation of "g" with altitude and depth, weightlessness, Satellite in circular orbit and applications, Geosynchronous orbit, basic idea of Global Positioning System(GPS). Frame of reference, Inertial and Non-inertial frame of reference, Galilean transformation, Postulates of special theory of relativity, Lorentz transformation, length contraction, Time dilation, Einstein's mass energy relation. Numericals 12 (periods)
*SEM Basics of Measurement Technique Measurements: Significance of measurements, methods of measurements, Static and dynamic characteristics: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements: Types of errors: i) Gross errors ii) Systematic errors iii) Random errors and loading effects. Statistical evaluation of measurement data: Arithmetic mean & median, Average deviation: Measurement with Screw Gauge, Vernier Caliper, Travelling Microscope, Spectrometer. (12 periods)	
COs: After completion of this course students will able to 1. apply the principles of measurement and error analysis. 2. Develop the skills to handle various instruments with precision.	

**Activities	<ol style="list-style-type: none"> 1. Measurement of dimension of solid block, volume of cylindrical objects, diameter of thin wire. 2. Measurement of length and diameter of capillary tubes. 3. Comparison of diameter of a thin wire using screw gauge and travelling microscope. 4. Measurement and estimation of errors in any one of the above activities.
--------------	--

Course Material/Learning Resources

Text books & Reference Books:

1. A Course in electrical & Electronic Measurements And Instrumentation by A. K. Sawhney, Dhanpatrai & Company (Pvt.) Ltd. Educational & Technical Publishers,
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper. PHI Learning Pvt. Ltd. New Delhi.
3. Measurement, Instrumentation And Experiment Design In Physics And Engineering By Michael Sayer, AbhaiMansingh, Phi Learning Private Ltd. New Delhi.
4. Electronic Instrumentation by H.S. Kalsi
5. Elements of Electronic Instrumentation and Measurement by Joseph J. Carr
6. A text book in Electrical Technology - B L Theraja - S Chand and Co.
7. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
8. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
9. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
10. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning
11. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
12. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
13. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
14. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley

Weblink to Equivalent MOOC on SWAYAM if relevant:

<https://nptel.ac.in>

Weblink to Equivalent Virtual Lab if relevant:

<https://vlab.amrita.edu/>

<https://www.vlab.co.in/>

<http://vlabs.iitb.ac.in/vlab/labsps.html>

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

<https://youtube.com/playlist?list=PLyQSN7X0ro203puVhQsmCj9qhIFQ-As8e>

Syllabus Prescribed for B.Sc. I Year UG Programme

Programme: Semester 1

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
----------------------------	---	-----------------------

PHY/S1

Physics Lab-1

6

COs

On successful completion of this practical course, the students would be able to

1. List out, identify and handle various equipment likes different types of pendulum.
2. Learn the procedures of operation of various oscillating objects.
3. Acquire skills in observing and measuring different types of errors.
4. Perform procedures and techniques related to experiments based on mechanics.
5. Conduct an experiments collaboratively and ethically.

*** List of Practical/Laboratory Experiments/Activities etc.**

It is necessary to perform TEN Experiments from the list given below.

1	To determine acceleration due to gravity by Bar pendulum.
2	To determine acceleration due to gravity by Kater's reversible pendulum.
3	To study oscillations in bifilar suspension arrangement
4	To determine Moment of Inertia of a body by a torsion pendulum.
5	To study the theorem of parallel axes of Moment of Inertia
6	To study the theorem of perpendicular of Moment of Inertia
7	To determine the Moment of Inertia of a body using bifilar suspension method (with parallel threads)
8	To determine the moment of inertia of a fly-wheel.
9	To determine the i) equivalent length, ii) radius of gyration, iii) moment of inertia of a compound pendulum by method of coincidences
10	To study the oscillations of a mass in combinations of two springs and hence determination of force constant.
11	To show that the frequency of a Helmholtz resonator varies inversely as the square root of its volume and to estimate the neck correction.
12	To determine Young's modulus of the material of a beam by method of vibration.
13	To determine Young's modulus of the material of a beam by method of bending.
14	To determine Young's modulus of the material of a beam by a cantilever.
15	To determine the Young's Modulus of a Wire by Optical Lever Method.
16	To determine modulus of rigidity of material of a given wire by Maxwell's needle.
17	To determine the modulus of rigidity of material of a given wire by using Torsional pendulum.
18	To determine coefficient of restitution for inelastic collision.
19	To determine the surface tension of mercury by Quinke's method

Text books & Reference Books:

15. *B.Sc. Practical Physics* by Harnam Singh & Dr. P. S. Hemne , 2000, S. Chand and Company Limited.
16. *A Textbook of Practical Physics* by Indu Prakash, Ram Krishna & A. K. Jha, 2011, Kitab Mahal Publication.
17. *B.Sc. Physics Practical* by C. L. Arora, 2010, S. Chand and Company Limited.

Weblink to Equivalent MOOC on SWAYAM if relevant:

<https://nptel.ac.in>

Weblink to Equivalent Virtual Lab if relevant:

<https://vlab.amrita.edu/>

<https://www.vlab.co.in/>

<http://vlabs.iitb.ac.in/v,.lab/labsps.html>

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

<https://youtube.com/playlist?list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e>