

ALLIEC COURSE PAPER-1: MECHANICS

Vectors: Vector algebra. Scalar & vector products. Derivatives of a vector with respect to a parameter. (4 Lectures)

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients. (6 Lectures)

Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. (10 Lectures)

Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets. (6 Lectures)

Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum. (5 Lectures)

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. GPS. Weightlessness. Physiological effects on astronauts. (5 Lectures)

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. (6 Lectures)

Speed Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities. (6 Lectures)

Note: Students are not familiar with vector calculus. Hence all examples involve differentiation either in one dimension or with respect to the radial coordinate.

Reference Books:

- University Physics. F W Sears, M W Zemansky and H D Young 13/e, 1986. Addison-Wesley
 - Mechanics Berkeley Physics course, v.1: Charles Kittel, et. Al. 2007, Tata McGraw-Hill.
 - Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
 - University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
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PHYSICS LAB.2: MECHANICS LAB.

(Students have to perform at least 5 experiments. Additional experiments may be included with the approval of the committee of courses)

1. To determine the Height of a Building using a Sextant.
2. To determine the Moment of Inertia of a Flywheel.
3. To determine the Young's Modulus of a Wire by Optical Lever Method.
4. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
5. To determine the Elastic Constants of a Wire by Searle's method.
6. To determine g by Bar Pendulum.
7. To determine g by Kater's Pendulum.
8. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g
9. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $\lambda^2 - T$ Law.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
 - Practical Physics, C.L Arora, 2001, S. Chand and Co.
 - A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
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