JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER

Programme: B.Sc. **Semester: I**

PHYSICS PAPER I
MECHANICS AND OSCILLATIONS

Course Code: 18IPH1 **No. of Hours: 60**

COURSE OBJECTIVES

- To generalize student's knowledge of one-dimensional motion. Two dimensional projectile motion and uniform circular motion will serve as specific applications.
- To gain knowledge of, and develop skills in the application of, Newton's Laws of Motion.
- To understand mechanical energy in its various forms and how the energy can be transformed from one form to another**.**

LEARNING OUTCOMES

- Apply knowledge of linear motion, forces, energy, and circular motion to explain natural physical processes and related technological advances.
- Use an understanding of algebraic mathematics along with physical principles to effectively solve problems encountered in everyday life, further study in science, and in the professional world.
- Students will develop an understanding of the distinction between conservative and non-conservative forces and how the presence of these forces influences the treatment of problems.

UNIT I

Theory of Errors **3 HRS**

Systematic and Random errors, Normal law of errors, Standard and Probable errors, Fractional error and Percentage error with examples. Propagation of errors. Least square fitting of data in linear case (qualitative). Problems

Motion in one dimension **5 HRS**

Motion with non- uniform acceleration with examples. Derivation of expressions for uniform and non-uniform acceleration of a body in linear motion. Fluid resistance of a resistive medium. Expressions for instantaneous position, speed, and acceleration of a body in linear motion in a resistive medium. Terminal velocity and derivation of expression for it. Problems.

Motion in two dimensions **4 HRS**

Relation between Cartesian and polar coordinates. Radial and transverse components of instantaneous velocity and acceleration of a body moving in a plane. Application to (i) uniform circular motion and (ii) areal velocity of a planet. Problems.

Frames of reference **3 HRS**

Inertial and Non-inertial frames of reference. Uniformly accelerated frames of reference in rectilinear motion, uniformly rotating frames of reference with examples. Coriolis force

(qualitative) and its application in the explanation of (i) erosion of river banks and (ii) trade winds.

UNIT II

Basic forces in Nature **2 HRS**

Classification of basic forces in nature and their properties with examples. Comparison of their order of magnitudes. Problems.

Friction **7 HRS**

Review of Frictional forces. Static, kinetic and rolling friction and the corresponding coefficients of friction. Laws of friction. Theory of a body rolling down an inclined plane, with and without friction. Free body diagrams for the following cases (i) Two masses connected by a string hanging over a frictionless pulley. (ii) Two masses in contact and masses connected by strings (horizontal only) (iii) Two masses connected by a string passing over a frictionless pulley fixed at the edge of a horizontal table. Problens

7. Oscillations **6 HRS**

Review of SHM. Energy of a particle in SHM. Damped and forced oscillations, resonance (qualitative). Vertical oscillations of a loaded spring. Theory of compound pendulum, coupled oscillators and derivation of angular frequency. Problems.

UNIT III

Work and energy **4 HRS**

Work done by constant and variable forces, with examples. Work-energy theorem. Conservative and non- conservative forces with examples. Conservation of energy. Characteristics of central force with examples. Spring force and Tensio . Problems.

Gravitation **3 HRS**

Newton's universal law of gravitation. Inertial and gravitational mass. Potential and field due to uniform spherical mass distribution. Problems.

Rocket and satellite motion **8 HRS**

Lijmitationsof Newtons Laws of motion Statements of Kepler's laws of planetary motion.. Systems of varying mass with examples. Review of orbital and escape velocity. Instantaneous velocity and acceleration of a single stage rocket, with and without gravitational effects. Launching of artificial satellites. Geostationary and geo-synchronous satellites. Need for multistage rockets. Problems.

UNIT IV

Center of mass **5 HRS**

Center of mass of a system of discrete particles and continuous mass distribution. Characteristics of centre of mass. CM of a two particle system. Concept of reduced mass. Motion of CM and conservation of linear momentum. Application of Newton's second law of motion to CM of a system and derivation of $F_{ext} = Ma_{CM}$. Problems.CM and Centre of gravity

Rotational motion of rigid bodies **10 HRS**

Review of moment of inertia and radius of gyration. Kinetic energy of rotation. Acceleration of a body rolling down a frictionless inclined plane. Parallel axes theorem. Perpendicular axes theorem for two dimensional and three dimensional bodies (with proof). Moment of inertia of a rectangular plate, disc and solid sphere about various axes. Theory of fly wheel. Angular momentum and its conservation with examples. Problems.

REFERENCE BOOKS FOR COURSE NO: PHY - 101

1. Mechanics, *D S Mathur*, Vikas Publishing House, 1978.
2. University Physics – 1, Mechanics of Particles: Waves and Oscillations, *Anwar Kamal*, New Age International, 2nd Edition, 2005
3. Concepts of Physics, Parts 1 & 2, *H.C.Verma*, Bharti Bhavan, 2002.
4. The Elements of Mechanics, *J P Agarwal & Satyaprakash*, Pragthi Prakashan, 1985.
5. A Text Book of Mechanics, *Bhargava & Sharma*, Ratan Prakash Mandir, 1990.
6. A Textbook on Oscillations: Waves and Acoustics, *M. Ghosh and D Bhattacharya*, S Chand and Co., 3rd Edition, 2006.
7. The world of Physics, *John Avison*, Nelson Publishers, 2nd Edition
8. Classical and Modern Physics, *Gettys etal*, McGraw Hill Book Company, International Edition, 1989.
9. Physics, *A F Abbott*, Heinemann Educational, 5th Edition.
10. Mechanics, Vol. 1, *C Kittel, W Knight, M A Rudermann*, TMH, 1989
11. Fundamentals of Physics, *R Resnick, D Haliday and K S Krane*, Asian Books Private Limited, New Delhi, 1994
12. Mechanics & Thermodynamics, *G Basavaraju & Dipan Ghosh*, TMI, 1984
13. Mechanics, Berkeley Physics Course – Volume (1), *Mittal, Knight & Rudermann*, TMH, New Delhi, 1981
14. University Physics, *F W Sears, M W Zemansky & H D Young*, Narosa Publications, New Delhi, 1987

Note: Browsing the Net for latest information on each topic is recommended.

PHYSICS PRACTICAL - 1

List of Experiments

1. Verification of conservation of linear momentum.
2. Determination of acceleration due to gravity using a bar pendulum (graphical method).
3. Determination of the frequency of a tuning fork using Helmholtz Volume Resonator.
4. Determination of damping coefficient of a rigid pendulum.
5. Conservation principle of energy.
6. Determination of moment of inertia and hence mass of a flywheel about its axis of rotation.
7. Determination of moment of inertia of a disc about an axis through its CG and perpendicular to its plane using a torsional pendulum.
8. Determination of moment of inertia of an irregular body about its axis of suspension by the method of torsional oscillations.
9. Verification of parallel axes theorem of moment of inertia.
10. Verification of perpendicular axes theorem of moment of inertia for a 2D body.
11. Study of periods of normal modes of a coupled oscillator (demonstration)

Note: (i) A minimum of **eight** experiments are performed.

(ii) Laboratory manual is prepared by the teaching faculty of Physics Department.

REFERNCES

1. Physics through Experiments, *B Saraf*, Vikas Publications.
2. A laboratory Manual of Physics for Undergraduate Classes, *D P Khandelwal*, Vani Publications.
3. Advanced Practical Physics for students, *Worsnop & Flint*, Methuen & Co., London.
4. An Advanced Course in Practical Physics, *D Chattopadhay, P C Rakshit, B Saha*, Central Book Agency (P) Limited, Kolkota, 6th Revised Edition.
5. B.Sc. Practical Physics, *C L Arora,* S Chand & Co., New Delhi, Revised Edition, 2007.
6. Advanced Level Practical Physics, *M Nelkon & J Ogborn*, Heinemann Educational Publishers, 3rd Revised Edition, 1970
7. Practical Physics, *G L Squires*, Cambridge University Press, 2001