B. Sc. I Year		**BPH-C101**			**Semester-I**
DSC 1		**MECHANICS**			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of TWO sections (Sec.-A, Sec.-B). Sec.-A shall contain 10 short answer type questions of Five mark each and student shall be required to attempt any Five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Vector Analysis: Vector algebra. Scalar and Vector product, Derivatives of a vector with respect to a parameter. Gradient, Divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors. **(10 Lectures)**

Laws of Motion: Frames of reference. Centre of Mass, Motion of C.M., Linear momentum in C.M. frame, Conservation of linear moemtum and Newton's third law. **(4 Lectures)**

Work and Energy: Work energy theorem. Potential energy, Energy, Force as gradient of potential energy, Conservative and non-conservative forces, Conservation of energy, General law of coservation of energy. Motion of rockets. **(6 Lectures)**

Rotational Motion: Angular velocity and angular momentum. Moment of Inertia, Torque. Conservation of angular momentum. Moment of Inertia, calculation of M.I. for rod, disc, solid cylinder, spherical shell and solid sphere, M.I. of Flywheel, M.I. of an irregular body. **(10 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. Weightlessness. Basic idea of global positioning system (GPS). Physiological effects on astronauts. Compound pendulum, Bar pendulum, Kater's pendulum, Bessel's theory of computed time. **(8 Lectures**)

Fluids: Viscosity: Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity of a liquid - Variations of viscosity of a liquid with temperature lubrication, Rotating cylinder method, Stokes Law. **(6 Lectures)**

Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Lorentz transformations. Length contraction. Time dilation. Relativistic addition of velocities. Variation of mass with velocity, Mass- energy equivalence. **(8 Lectures)**

Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants-Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants- Work done in stretching and work done in twisting a wire -Twisting couple on a cylinder-Determination of Rigidity modulus by static torsion- Torsional pendulum-Determination of Rigidity modulus - Y, η and σ by Searles method. **(8 Lectures)**

Reference Books

- University Physics. FW Sears, MW Zemansky and HD Young13/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.

(i) Course learning outcome:

After going through the course, the student should be able to

- Understand the role of vectors and coordinate systems in Physics.
- Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.
- Explain the conservation of energy, momentum, angular momentum and apply them to basic problems.
- Understand the analogy between translational and rotational dynamics, and application of both motions simultaneously in analyzing rolling with slipping.
- Apply Kepler's law to describe the motion of planets and satellite in circular orbit.
- Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.
- Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward pull.
- Describe special relativistic effects and their effects on the mass and energy of a moving object.
- In the laboratory course, after acquiring knowledge of how to handle measuring instruments (like screw gauge, vernier callipers, Travelling microscope) student shall embark on verifying various principles learnt in theory. Measuring 'g' using BarPendulum, Kater pendulum and measuring elastic constants of materials, viscous properties of liquids etc.

(ii) Broad contents of the course

- Vectors
- Ordinary Differential Equations
- Laws of Motion
- Momentum and Energy
- Rotational Motion
- Gravitation
- Oscillations
- Elasticity
- Special Theory of Relativity

(iii) Skills to be learned

- Learn basic mathematics like vectors and ordinary different equation and to understand linear and rotational motion.
- Learn basics of Newtonian gravitation theory and central force problem.
- Learn basic ideas about mechanical oscillators.
- Learn elasticity and elastic constants of material and perform experiments to study them.
- Acquire basic knowledge of special theory of relativity.