CLUSTER UNIVERSITY SRINAGAR

SYLLABUS (FYUP UNDER NEP 2020)

Offered By Department PHYSICS

Semester 1st (Major Course)

Course Title: Mechanics

Course Code: UGPHY22J101 **Max. Marks 100**
Credits: 4 (Theory: 3, Practical: 1) **Theory External: 60; Min Marks: 24**
Contact Hrs: 75 (Theory: 45, Practical: 30) **Theory Internal (Continuous Assessment): 15 Marks, Min Marks: 06**
Practical Experimental Basis= 15, Min. Marks: 06
Practical Internal (Continuous assessment) = 10, Min. Marks: 04

Objectives:

The objective of the course is to present mechanics in a form which offers sufficient support for broadening the outlook of the students viz a viz mechanics.

By the end of the course the student shall have developed the ability of solving mechanics based problem using dierent approaches & shall also be able to estimate the approach used to tackle advanced problems.

Course Outcomes: Students shall be able to

1. Understand vectors Geometrically & deal with them analytically as well.
2. Understand spherical coordinate system, non xed base vectors, and express derivatives of position vector in terms of these coordinates.
3. Understand Newton's Laws and apply them to Mechanical systems, & many particle systems in translational and rotational motion.
4. Understand Conservation Laws and Work Energy theorem & apply them to various systems as variable mass, collisions and rotations of a rigid body.
5. A hands on experience is provided by the Laboratory Course.

UNIT I **15 Hours**

Coordinate Systems & Laws of Motion

Vectors: - Definition, Vector Algebra (Geometric & Component form):Scalar Multiplication, Addition, Sub-traction, Associative, Commutative, and Distributive Law, Multiplication: Scalar and Vector Product, Area as a Vector, Base Vectors in Cartesian System.

Spherical Coordinates:- Spherical Polar coordinates: Relation to cartesian coordinates, base vectors, expression for Velocity & acceleration.

Laws of Motion:- Newton's First, Second & Third Law of Motion, Applications.

UNIT II **15 Hours**

Center of Mass & Conservation Laws

Center of Mass:- System of interacting particles, Center of Mass(CM), Motion of CM: Velocity & acceleration. Momentum:- Law of Conservation of Momentum, Impulse, System of Variable mass: Rocket Motion.

Work & Energy:- Infinitesimal work, Integration of Equations of motion with Force function, Conservative force: basic concept of gradient. Work-Energy theorem, Applications of Work-Energy theorem, Potential Energy, Conservative Force as gradient of Potential function, Stability & Potential Energy. The Law of Conservation of Mechanical energy & Applications.

UNIT III **15 Hours**

Rigid Body Dynamics

Particle Collisions:- Elastic Collisions of 2 particles in 1 Dimensions, Collisions in Center of Mass Coordinates. Angular **Momentum:-** Angular momentum of a particle, Torque, Rotation along Fixed axis, Moment of inertia, Axis theorems. Dynamics of pure rotation about z- axis, Combined Translation & Rotation. Motion of Rigid Body:- Finite & infinitesimal rotations, Gyroscope, Angular velocity as Vector, Conservation of Angular momentum, Angular momentum of a rotating rigid body, Rotational kinetic energy.

UNIT IV **30 Hours**

PRACTICALS (Laboratory Course)

List of Experiments:

1. Use of Vernier Calliper, Screw Guage & Spherometer.
2. Determination of value of g by Bar pendulum.
3. Determination of value of g by Kater's pendulum.
4. To study the motion of a spring and calculate (a) spring constant (b) value of g.
5. To Study laws of parallel and perpendicular axis for moment of inertia.
6. To determine the moment of inertia of a fly wheel
7. Determination of moment of inertia using Bifilar pendulum.
8. To Find the Moment of inertia of an irregular body about an axis through its centre of gravity with torsional pendulum.
9. Determination of Young's Modulus of elasticity by bending beam method.
10. Determination of Modulus of rigidity of a given wire by Maxwell's Needle.

Suggested Readings:

1. *An Introduction to Mechanics, Daniel Kleppner, Robert J. Kolenkow, McGraw Hill Education, 2016.*
2. *B.Sc. Practical Physics, C. L. Arora, S Chand & Company, 2010.*
3. *Mechanics, H. S. Hans, S. P. Puri, 2nd Edition, Tata McGraw Hill, 2003.*
4. *Mechanics, D. S. Mathur, Revised Edition, S.Chand Publications, 2006.*
5. *Mechanics: Berkeley Physics Course Volume I, C. Kittel, W. Knight, M. Ruderman, C. Helmholz, B. Moyer, 2nd Edition, Tata McGraw Hill, 2017.*
6. *Physics Volume I, R. Resnick, D. Halliday & K. S. Krane 5th Edition, Wiley, 2007.*
7. *Classical Mechanics, T. Kibble, F. H. Berkshire, 5th Edition, Imperial College Press, 2004.*
8. *Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, Asia Publishing House, 1971.*
9. *Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, Heinemann Educational Publishers, 1985.*