ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

II SEMESTER PHYSICS Time:5hrs/week PH-Mi1-2401(3) MECHANICS AND PROPERTIES OF MATTER Marks:100 w.e.f AK 2023-2024 (Admitted batch) SYLLABUS

COURSE OBJECTIVE:

❖ The course on Mechanics and Properties of Matter aims to provide students with a fundamental understanding of the behaviour of physical systems, both in terms of mechanical motion and in terms of the properties of matter

LEARNING OUTCOMES:

- Students will be able to understand and apply the concepts of scalar and vector fields, calculate the gradient of a scalar field, determine the divergence and curl of a vector field.
- Students will be able to apply the laws of motion, solve equations of motion for variable mass systems
- Students will be able to define a rigid body and comprehend rotational kinematic relations, derive equations of motion for rotating bodies, analyze the precession of a top and gyroscope, understand the precession of the equinoxes
- Students will be able to define central forces and provide examples, understand the characteristics and conservative nature of central forces, derive equations of motion under central forces.
- ❖ Students will be able to differentiate between Galilean relativity and the concept of absolute frames, comprehend the postulates of the special theory of relativity, apply Lorentz transformations, understand and solve problems

UNIT - I: VECTOR ANALYSIS:

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface and volume), Statement and proof of Gauss and Stokes theorems.

UNIT - II: MECHANICS OF PARTICLES:

Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, Rutherford scattering-derivation.

UNIT-III: MECHANICS OF RIGID BODIES AND CONTINUOUS MEDIA

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, Precession of a top, Gyroscope, Precession of the equinoxes. Elastic constants of isotropic

solids and their relations, Poisson's ratio and expression for Poisson's ratio. Classification of beams, types of bending, point load, distributed load.

UNIT - IV: CENTRAL FORCES:

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, conservative force as a negative gradient of potential energy, equations of motion under a . Derivation of Kepler's laws. Motion of satellites

UNIT – V: SPECIAL THEORY OF RELATIVITY:

Galilean relativity, Absolute frames. Michelson-Morley experiment, The negative result. Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation.

REFERENCE BOOKS:

- 1. BSc Physics -Telugu Akademy, Hyderabad
- 2. Mechanics D.S. Mathur, Sulthan Chand & Co, New Delhi
- 3. Mechanics J.C. Upadhyaya, Ramprasad& Co., Agra
- 4. Properties of Matter D.S. Mathur, S.Chand& Co, New Delhi ,11thEdn., 2000
- 5. Physics Vol. I Resnick-Halliday-Krane ,Wiley, 2001
- 6. Properties of Matter Brijlal&Subrmanyam, S. Chand &Co. 1982
- 7. Dynamics of Particles and Rigid bodies Anil Rao, Cambridge Univ Press, 2006
- 8. Mechanics-EM Purcell, Mc Graw Hill
- 9. University Physics-FW Sears, MW Zemansky& HD Young, Narosa Publications, Delhi
- 10. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
- 11. Mechanics, S. G. Venkatachalapathy, Margham Publication, 2003.

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