



27121(New)

B.Sc I Semester Degree Examination, Oct./Nov.-2018

PHYSICS

Mechanics and Properties of Matter

Paper - 1.1

(New)

Time : 3 Hours

Maximum Marks : 60

Instructions to Candidates:

- 1) Part A : All are Compulsory.
2. Part B : Solve any **FIVE** questions from 7 questions.

PART - A

1. Answer the following questions

(10×1=10)

- a) What is Coriolis force?
- b) State the law of conservation of linear momentum.
- c) What is central force?
- d) Define escape velocity.
- e) Define radius of gyration.
- f) State the theorem of parallel axes.
- g) Define Poisson's ratio.
- h) What is meant by bending moment?
- i) Define surface tension.
- j) What is streamline flow?

PART - B

Answer the following any **FIVE** questions (Each question carries equal marks)

2. a) Obtain the Galilean transformation equations when two frames S and S' are moving with uniform relative velocity. Show that the law of conservation of energy is invariant under Galilean transformations.
- b) Two particles of masses 2 kg and 3 kg have positions at $3\hat{i} + 2\hat{j} - \hat{k}$ and $-2\hat{i} + 2\hat{j} + 4\hat{k}$ respectively in a space. Find the position of centre of mass. **(7+3)**

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3. a) Discuss inelastic collision between two particles which stick together in
i) Laboratory frame of reference and ii) Centre of mass frame of reference.
b) A rocket starts from rest with exhaust velocity of gases 1.6 Km/sec. Find the ratio of its initial mass to the mass when its velocity reaches 10 Km/sec. (7+3)
4. a) State and prove Kepler's second law using vector notation.
b) Derive an expression for the time period of light spiral spring. (6+4)
5. a) Obtain an expression for radial and transverse component of velocity and acceleration of a particle executing uniform circular motion.
b) The escape velocity of earth is 11.2 Kms^{-1} Find the escape velocity of a planet whose radius is twice that of earth and whose mass is thrice that of earth. (7+3)
6. a) Derive an expression for the moment of inertia of a circular disc.
i) About an axis perpendicular to its plane and passing through its centre.
ii) About its diameter.
b) A solid cylinder of mass 5 kg, diameter 0.1 m and length 1 m is rotating about an axis passing through its centre of gravity and perpendicular to its length. Calculate its moment of inertia. (7+3)
7. a) What is cantilever? Obtain an expression for the depression produced at free end of a light cantilever.
b) Calculate the Young's modulus of the material of a wire of 3 m long and 1 mm radius when the force of 950 N increase its length by 5 mm. (7+3)
8. a) Define coefficient of viscosity for a liquid. Derive Poiseuille's equation for the flow of liquid through a tube.
b) Calculate the depth of water at which an air bubble of radius $4 \times 10^{-4} \text{ m}$ may remains in equilibrium if surface tension of water is $72 \times 10^{-3} \text{ Nm}^{-1}$ (Density of water = 1000 kg/m^3) (7+3)
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