



31130

(NEP)

B.Sc. I Semester Degree Examination, February/March - 2023

PHYSICS

Mechanics and Properties of Matter

Paper : DSC-A1

Time : 3 Hours

Maximum Marks : 60

*Instructions to candidates :*

- 1) Part - A : All questions are compulsory.
- 2) Part - B : Answer any Five questions.

PART - A

1. Answer the following questions. (5×2=10)
- a) What is a systematic error? How can it be removed?
  - b) State Newton's Laws of motion.
  - c) What is compound pendulum? Write the expression to find the time period of a compound pendulum.
  - d) Distinguish between Surface tension and Surface energy.
  - e) Define coefficient of viscosity of a liquid. How coefficient of viscosity of liquid vary with temperature and pressure?

PART - B

Answer any FIVE questions. (5×10=50)

2.
  - a) State and explain the law of conservation of linear momentum of a system of particles.
  - b) A certain process requires  $10^{-6}$  s to occur in an atom at rest in laboratory. How much time will this process require to an observer in the laboratory when an atom is moving with a speed of  $5 \times 10^7$  ms<sup>-1</sup>? (6+4=10)
3.
  - a) Derive an expression for length contraction.
  - b) A machine gun of mass 10kg fires 30g bullet at the rate of 6 bullets per second with a speed of 400 ms<sup>-1</sup>. What force must be applied to the gun to keep it in position? (6+4=10)

[P.T.O.]



4. a) Derive an expression for moment of inertia of a solid cylinder about an axis passing through its centre of mass and parallel to its length.
- b) Calculate the Young's modulus of the material of a wire of 3m long and 1mm radius, when the force of 950 newton increases its length by 5 mm. (6+4=10)
5. a) State and explain Newton's law of gravitation.
- b) Show that the work done per unit volume in stretching a wire is equal to
- $$\frac{1}{2} (\text{Stress} \times \text{Strain}). \quad (6+4=10)$$
6. a) Define Young's modulus and rigidity modulus. Obtain an expression relating three moduli of elasticity.
- b) Calculate the excess pressure inside a soap bubble of radius  $2 \times 10^{-3}$ m. Surface tension of soap solution is  $20 \times 10^{-3}$  Nm<sup>-1</sup>. Also calculate surface energy. (6+4=10)
7. a) Define a Cantilever. Obtain an expression for the depression produced at its free end when the weight of the beam is negligible.
- b) A horizontal force of 100 N is required to move a metal plate of area 4 m<sup>2</sup> with a velocity 0.15ms<sup>-1</sup>, when it rests on a layer of a liquid of thickness  $4 \times 10^{-3}$ m. Calculate the Co-efficient of Viscosity of the oil. (6+4=10)
8. a) Obtain an expression for excess pressure on curved surface.
- b) Derive Stoke's law by the method of dimensions. (6+4=10)
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B.Sc. I Semester Degree Examination, March/April 2022

PHYSICS

Paper – PHY DSC A1 : Mechanics and Properties of Matter

Time : 3 Hours

Max. Marks : 60

**Instructions :** 1) Part – A : All questions are compulsory.  
2) Part – B : Answer any five full questions.

PART – A

1. Answer the following questions :

(10×1=10)

- a) Define the dimensions of a physical quantity.
- b) What is energy ?
- c) What is time dilation ?
- d) Define centre of mass frame of reference.
- e) What is compound pendulum ?
- f) What are satellites ?
- g) Define angle of shear.
- h) What is cantilever ?
- i) Define surface tension.
- j) Define co-efficient of viscosity.

PART – B

2. a) Write a note on system of units.

(5×10=50)

b) Discuss briefly the various types of errors.

(5+5)

3. a) What is rocket ? Derive the expression for the velocity of a rocket at any instant when the total mass of the rocket is M.

b) A 30 gram bullet initially travelling  $500 \text{ ms}^{-1}$  penetrates 12 cm into a wooden block. What average force does it exerts ?

(6+4)

4. a) Explain Michelson-Morely experiment.

b) A 50 gram bullet leaves a rifle with a velocity of 400 m/s and the rifle recoils with a velocity of 0.5 m/s. What is the mass of the rifle ?

(6+4)

P.T.O.



5. a) State and explain Newton's laws of motion.
- b) A solid cylinder of mass 40 kg rotates about its axis with angular speed 200 radians per second. The radius of the cylinder is 0.5 m. What is the K.E associated with the rotation of the cylinder ? (6+4)
6. a) State Kepler's laws of planetary motion.
- b) Write a note on geostationary satellites.
- c) Two spheres of masses  $3 \times 10^{-3}$  kg and 0.5 kg respectively, placed at a distance of 0.05 m apart attract each other with a force of  $4 \times 10^{-11}$  N. Find the value of gravitational constant. (3+4+3)
7. a) Deduce the relation between Young's modulus, Bulk modulus, Rigidity modulus and Poisson's ratio.
- b) A steel rod of length 50 cm, width 2 cm and thickness 1 cm is bent into the form of an arc of radius of curvature 2.0 m. Calculate the bending moment. Young's modulus of the material of the rod =  $2 \times 10^{11}$  N/m<sup>2</sup>. (6+4)
8. a) Obtain an expression for excess pressure on curved surface.
- b) Water flows through a horizontal tube of length 0.40 m and internal diameter  $0.2012 \times 10^{-2}$  m under a constant pressure head of liquid  $5.1 \times 10^{-2}$  m. If  $24 \times 10^{-6}$  cubic metre of water issues from the tube in 40 seconds, find the co-efficient of viscosity of water. Density of water  $\rho = 10^3$  kgm<sup>-3</sup> and  $g = 9.8$  ms<sup>-2</sup>. (6+4)
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27121(New)

B.Sc. I Semester Degree Examination, March/April - 2021

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.

**PART - A**

1. Answer the following questions :

(10×1=10)

- a) State Galilean Principle of relativity.
- b) Define inelastic collision.
- c) Define angular momentum.
- d) What is central force?
- e) Define orbital velocity.
- f) State parallel axes theorem.
- g) Define Poisson's ratio.
- h) Define moment of inertia.
- i) Define angle of contact.
- j) What is streamline flow?

**PART - B**

2. a) Obtain the Galilean transformation equations when two frames S and S' are moving with uniform relative velocity. Show that law of conservation of linear momentum is invariant under Galiean transformations. (7+3=10)
- b) Two particles of masses 5 kg and 10 kg have positions at  $3\hat{i} + 2\hat{j} + 3\hat{k}$  and  $-2\hat{i} + 3\hat{j} + \hat{k}$  respectively. Find the position vector of centre of mass.

[P.T.O.]



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27121(New)

3. a) Derive equations for velocities of two particles in an inelastic collision in one dimension with respect to laboratory and centre of mass frame of reference. (7+3=10)
- b) Show that kinetic energy is lost during inelastic collision.
4. a) State and prove law of conservation of angular momentum. (7+3=10)
- b) Show that angular momentum of a particle moving under central force is conserved.
5. a) Obtain an expression of escape velocity of satellite. (7+3=10)
- b) Calculate the value of escape velocity for an atmospheric particle 1000 km above the surface of earth.
- Given : Mass of earth =  $5.98 \times 10^{24}$  kg.  
Radius of earth =  $6.37 \times 10^6$  m.  
Gravitational constant  $G = 6.67 \times 10^{-11}$  Nm<sup>2</sup>/kg<sup>2</sup>.
6. a) Derive an expression for time period of a compound pendulum and show that centre of oscillation and centre of suspension are interchangeable. (7+3=10)
- b) Calculate the moment of inertia of a rectangular rod about an axis perpendicular to its plane and passing through its centre of gravity.
- Given : Mass of the rod = 4 kg.  
Length of the rod = 0.2 m.  
Breadth of the rod = 0.05 m.
7. a) What is cantilever? Obtain an expression for depression produced at free end of a light cantilever. (7+3=10)
- b) A wire of length 4m and area of cross section  $5 \times 10^{-7}$  m<sup>2</sup> is fixed at one end. A load of mass 2.5kg is applied to the other end and hung freely. If the elongation of the wire is  $10^{-3}$  m. Calculate young's modulus.
8. a) Derive Poiseuille's equation for coefficient of viscosity of liquid. (7+3=10)
- b) Calculate the excess pressure inside a soap bubble of radius  $4 \times 10^{-3}$  m. Surface tension of soap bubble is  $25 \times 10^{-3}$  N/m.
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