

B.Sc. F.Y. (NEP) - Semester-I
BSCPH501 - (Core) - Physics (Mechanics)

P. Pages : 3

Time : Two Hours



GUG/W/24/15916

Max. Marks : 40

- Notes :
1. All questions are compulsory.
 2. Draw neat and well labelled diagram wherever necessary.
 3. Scientific calculator allowed in exam.

Either :

1. A) i) What is torsional pendulum? Describe the method of measurement of the modulus of rigidity of a wire by dynamic method. 4
- ii) Obtain an expression for work done in stretching a wire under the load. 2
- iii) Calculate the rigidity modulus of copper. Given that for copper $y = 11.7 \times 10^{10} \text{ N/m}^2$ and $\sigma = 0.35$. 2

OR

- B) a) Define the three moduli of elasticity of a material and state their SI unit. 2
- b) Define Poisson's ratio. What are its limiting values? 2
- c) Assuming the relationship for k and n in terms of y and σ 2
show that $\frac{9}{y} = \frac{3}{n} + \frac{1}{k}$
- d) Calculate the Poisson's ratio for silver. Given Young's modulus for silver is $7.25 \times 10^{10} \text{ N/m}^2$ and bulk modulus is $11 \times 10^{10} \text{ N/m}^2$ 2

Either :

2. A) i) What is simple harmonic motion? 1
- ii) Derive a general differential equation of motion of a simple harmonic oscillator and obtain its solution. 5
- iii) Derive an expression for the total energy of a simple harmonic oscillator. 2

OR

- a) Explain Damped and forced harmonic oscillations. 2
- b) Explain the phenomenon of perfectly inelastic collision in one dimension between two particles. 2

- c) Write the application of elastic collision. 2
- d) Two objects of mass $M_1 = 2\text{gm}$ and $M_2 = 5\text{gm}$ possess velocity $u_1 = 10\text{ cm/sec}$ and $u_2 = 5\text{ cm/sec}$. They suffer an elastic collision. Find the velocities of both the objects after collision. 2

Either :

3. A) i) Define centre of mass. Derive an expression of Position vector, velocity and linear momentum of centre of mass of systems 4
- ii) State and prove law of conservation of linear momentum for a particle. 2
- iii) Derive the relation between torque and moment of inertia. 2

OR

- B) a) Show that in a central force field the angular momentum of a particle is conserved. 2
- b) Explain the terms 2
- i) Gravitational field
- ii) Gravitational potential
- c) Derive the expression of gravitational self energy of a body. 2
- d) The radius of earth is $6.637 \times 10^6\text{ m}$, its density $5.57 \times 10^3\text{ kg/m}^3$ and gravitational constant $6.6 \times 10^{-11}\text{ Nm}^2/\text{kg}$. Calculate the earth's surface potential. 2

Either :

4. A) i) Derive an expression for relativistic variation of mass with velocity. 4
- ii) State and explain postulates of special theory of relativity. 2
- iii) Find the percentage contraction in the length of a rod in a frame of reference moving with a velocity $0.8c$ in a direction parallel to its length? 2

OR

- B) a) Distinguish between inertial and non-inertial frame of reference. 2
- b) Derive an expression for time dilation. 2
- c) Establish the Einstein's mass energy equation. 2
- d) What is the gain in mass of an electron if it is accelerated to kinetic energy of 200 MeV from rest position? ($1\text{eV} = 1.6 \times 10^{-19}\text{ J}$) 2

5. Solve any eight from the following

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| a) What is torsional pendulum? | 1 |
| b) Define elastic limit. | 1 |
| c) Distinguish between elasticity and plasticity. | 1 |
| d) Define free oscillation. | 1 |
| e) Define collision. | 1 |
| f) A mass of 1kg is attached to a spring of stiffness constant 16 N/m. Find its natural frequency. | 1 |
| g) What is moment of inertia? | 1 |
| h) State Newton's law of gravitation. | 1 |
| i) Define torque | 1 |
| l) What is proper length? | 1 |
| k) Define frame of reference. | 1 |
| l) State drawbacks of Galilean transformation | 1 |
