BENGALURU CITY UNIVERSITY

I Semester B.Sc. Degree Examination

Phy.DSCT1: Mechanics Properties of Matter

Time: 2 Hours] *[Max. Marks: 60]*

Instructions to Candidates:

1. *Answer **all** the questions from PART- A*
2. *Answer **any three** questions from PART- B and PART -C*
3. *Answer **any five** questions from PART -D*
4. *Use of non-programmable scientific calculator is allowed.*

PART-A

Answer **all** the questions. Each question carries **1 mark**: **(5 x 1 = 5)**

1. The dimension of Gravitational constant is _____

   (a) $[M^{-1} L^{3} T^{-2}]$ (b) $[M^{-1} L^{2} T^{-2}]$

   (c) $[M^{-1} L^{3} T^{-5}]$ (d) $[M^{-2} L^{3} T^{-2}]$

2. In the case of uniform circular motion of a body, which one of the following physical quantities does not remain constant?

   (a) mass (b) speed

   (c) linear momentum (d) kinetic energy

3. The modulus of elasticity of a material does not depend upon

   (a) shape (b) temperature

(c) nature of material (d) impurities mixed

4. The fluid flow remains streamlined as long as it's velocity is _____

(a) below its critical velocity (b) equal to the square of its critical velocity

(c) equal to critical velocity (d) equal to the square root of its critical velocity

5. The cause of surface tension is

(a) intermolecular forces (b) viscous force

(c) gravitational force (d) nuclear force

PART B

Answer any **THREE** questions. Each question carries **10 marks**: (3 × 10 = 30)

6 a) Derive an expression for work done by a variable force.

b) Obtain an expression for length contraction of a moving rod on the basis of special theory of relativity. (5+5)

7 Derive an expression for the moment of inertia of a plane rectangular lamina about an axis passing through its centre and perpendicular to its (i) plane, (ii) length and (iii) breadth (10)

8 a) State Kepler's laws of planetary motion.

b) Derive an expression for orbital velocity of a satellite orbiting with a radius 'r' centered on the planet. (3+7)

9 a) What is surface tension? Write its SI unit.

b) Derive an expression for the difference of pressure between the two sides of a curved liquid surface. (2+8)

10 a) Obtain an expression for terminal velocity of a small solid sphere falling freely under gravity in a viscous liquid.

b) Describe with diagram an experiment to determine the coefficient of viscosity of a liquid by Poiseuille's method. (5+5)

PART C

Solve any **THREE** problems. Each problem carries **5 marks**: **(3 ×5 = 15)**

11 A clock keeps correct time. With what speed should it be moved related to an observer so that it may seem to loose one minute in one- day.

12 A car of mass 1500 kg moves with a linear speed of 40 ms^{-1} on a circular race track of radius 50 m. What is the magnitude of its angular velocity and angular momentum relative to the centre of the track?

13 The force of attraction between two sphere of masses 40 kg and 10 kg equal to the weight of a body of mass 10.94×10^{-9} kg. If the distance between the centres of the spheres is 0.5 m, calculate the value G. Given g=9.8 ms^{-2}

14 Calculate the force required to stretch a steel wire $\mathbf{1}\times10^{-4}$ m^2 in cross section to increase its length by 0.1% of its original length. Given Young's modulus = $2 \times 10^{11} Nm^{-2}$.

15 Calculate the excess pressure inside a soap bubble of radius $\mathbf{3}\times10^{-3}$ m. Surface tension of soap solution =$\mathbf{20}\times10^{-3}$ Nm^{-1}. Also calculate the surface energy.

PART D

Answer any **FIVE** questions. Each question carries **2 marks**: **(2 ×5 = 10)**

16 a) How random errors and systematic errors be reduced?

b) Can a body have energy without momentum? Justify.

c) Why is most of the mass concentrated at the rim in a flywheel?

d) When an object falls to the earth, the earth also moves up to meet it. Why the earth's motion is not noticeable?

e) Can steel be preferred than copper for making springs? Explain.

f) Can Poisson's ratio of any material be less than –1? Explain.

g) Water sticks to a glass surface, while mercury does not. Explain.

h) Which type of flow is preferred for mixing of two fluids? Explain.