TDC Odd Semester Exam., 2020
held in July, 2021

PHYSICS

(Honours)

(**1st Semester**)

Course No. : PHSH–101

(**Mechanics and General Properties of Matter**)

Full Marks : 35
Pass Marks : 12

Time : 2 hours

The figures in the margin indicate full marks
for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Distinguish between inertial frame of reference and non-inertial frame of reference. 3

   (b) Derive the transformation equation of force in rotational frame of reference. 4

(**2**)

2. *(a)* What is a conservative force? State the properties of a conservative force. 1+3=4

   (b) Show that the force

   $$\vec{F} = yz\hat{i} + zx\hat{j} + xy\hat{k}$$

   is a conservative force. 3

UNIT—II

3. What are the elastic and inelastic collisions? Find the expression of velocities of two bodies after elastic collision in a laboratory frame.
   2+5=7

4. What do you mean by the centre of mass frame of reference? Show that the centre of mass of a system of particles moves as if it were a particle of mass equal to the total mass of the system, subjected to the external forces applied to the system. 2+5=7

UNIT—III

5. Define angular momentum of a particle. Show that the time rate in change of angular momentum of a particle is equal to the torque acting on it. Prove that for a central force, the angular momentum is conserved.
   1+3+3=7

(3)

6. *(a)* State and prove the theorem of perpendicular axes in connection with moment of inertia. 1+3=4

(b) Calculate the moment of inertia of a cylinder about its axis. 3

UNIT—IV

7. *(a)* What do you mean by gravitational potential at a point? Obtain an expression for the gravitational potential at a point due to a circular disc. 1+3=4

(b) How would you determine the value of acceleration due to gravity by means of Kater's pendulum? 3

8. What are Young's modulus Y, bulk modulus K and the modulus of rigidity η? Show that

$$\frac{3}{\eta} = \frac{1}{K} + \frac{9}{Y}$$

3+4=7

UNIT—V

9. *(a)* What is surface tension? Find the expression for the excess pressure inside a bubble of radius r. 1+4=5

(4)

(b) Calculate the excess pressure inside a soap bubble of radius 3×10^{-3} m. Surface tension of soap solution is 20×10^{-3} N/m. 2

10. Define coefficient of viscosity of a liquid and find its dimensions. Discuss the Poiseuille's method as applied in the determination of viscosity of a liquid. 2+5=7

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