TDC (CBCS) Odd Semester Exam., 2020
held in March, 2021

PHYSICS

(1st Semester)

Course No. : PHSHCC-102T

(Mechanics)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

1. Answer any *ten* of the following questions : 2×10=20

(a) What do you mean by reference frame?

(b) Show that the path of a projectile as seen from another projectile will always be a straight line.

(c) Explain the principle of conservation of momentum.

(d) Define conservative and non-conservative forces.

(e) Show that torque is given by the time rate of change of angular momentum.

(f) Define elastic constants.

(g) Write the physical significance of moment of inertia.

(h) State the theorems of parallel and perpendicular axis for moment of inertia.

(i) Find the intensity of gravitational field due to a thin spherical shell at a point outside the shell.

(j) What is the difference between inertial and gravitational mass?

(k) Find the gravitational potential on the surface of a spherical cell.

(l) The earth mass is 80 times that of the moon and their diameters are 12800 km and 3200 km respectively. What is the value of g on the moon, if g on the earth is $9 \cdot 8\ m/s^2$?

(m) What is the equation of SHM? Explain it.

(n) Find an expression of kinetic energy of a body executing SHM.

(o) Define sharpness of resonance.

(p) What is quality factor?

(q) State postulates of special theory of relativity.

(r) Write the aim of Michelson-Morley experiment.

(s) What do you mean by mass-energy equivalence?

(t) Write a short note on time dilation.

SECTION—B

Answer *any* **five** questions

2. (a) Show that force as gradient of potential energy.

(b) Explain the terms from a potential energy curve, stable and unstable equilibrium. 3+3=6

3. *(a)* Show that the laws of conservation of momentum and energy are invariant to Galilean transformation.

(b) Calculate the position, velocity and acceleration of centre of mass of two particles. 3+3=6

4. *(a)* Show that torque is given by the time rate of change of angular momentum.

(b) State and prove the theorem of perpendicular axis for moment of inertia. 3+3=6

5. Show that $K = \frac{Y}{3(1-2\sigma)}$, where symbols have their usual meanings. 6

6. Describe briefly about gravitational potential. Show that gravitational potential at the centre of a solid sphere is $\frac{3}{2}$ times that on the surface. 2+4=6

7. *(a)* State Kepler's three laws of planetary motion.

(b) What is geosynchronous orbit and global positioning system? 3+3=6

8. *(a)* What are the important characteristics of SHM?

(b) Show that total energy of a body executing SHM is constant at any instant. 2+4=6

9. *(a)* Write short notes on non-inertial frames and fictitious forces.

(b) Find the condition of resonance. 3+3=6

10. Find an expression for expected fringe shift in Michelson-Morley experiment. 6

11. Derive Lorentz transformation equations. 6

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