US – 331

II Semester B.Sc. Examination, May 2017
(CBCS) (Freshers) (2016-17 and Onwards)
PHYSICS – II
Mechanics – 2, Heat and Thermodynamics – 2

Time : 3 Hours Max. Marks : 70

Instruction : *Answer* ***five*** *questions from* ***each*** *Part.*

PART – A

Answer **any five** questions. **Each** question carries **eight** marks. **(5×8=40)**

1. a) What is periodic motion ? Give an example.
   b) What is compound pendulum ? Deduce an expression for its time period. **(2+6)**

2. a) Arrive at the relation between elastic constants $K = \frac{q}{3[1-2\sigma]}$ where symbols have their usual notations.
   b) Write the theoretical and practical limiting values of Poisson's ratio. **(6+2)**

3. a) Give the significance of thermodynamic potentials.
   b) Using Maxwell's thermodynamic relations obtain an expression for the difference in specific heats for a perfect gas. **(2+6)**

4. a) Explain melting and sublimation of a solid.
   b) Deduce an expression for Joule-Thomson coefficient. **(2+6)**

5. a) Distinguish between inertial and non-inertial frames of reference.
   b) Show that acceleration is invariant under Galilean transformations. **(2+6)**

6. a) State the postulates of special theory of relativity.
   b) Obtain Lorentz transformation equations. **(2+6)**

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7. a) Define moment of inertia.

   b) Deduce an expression for moment of inertia of a solid sphere about an axis passing through its diameter. **(2+6)**

8. a) What is wave motion ? Mention the characteristics of a wave.

   b) Derive the equation of a progressive wave. **(4+4)**

PART – B

Answer **any five** problems. **Each** problem carries **4** marks. **(5×4=20)**

9. A particle of mass 0.01 kg, executing SHM makes 30 oscillations in 2s with an amplitude of 0.08 m. Find the maximum velocity of the particle.

10. A sphere is suspended from a wire of length 1 m and radius 0.5×10^{-3} m. If the period of torsional oscillations is 1.23 s and moment of inertia of the sphere about an axis through its diameter is 0.03×10^{-2} kg m^2, calculate rigidity modulus of the material of the wire.

11. Calculate the decrease in the melting point of ice when the pressure changes by 1 atmosphere, specific volume of ice at 273 K is 1.091×10^{-3} m^3 kg^{-1} and that of water at 273 K is 10^{-3} m^3 kg^{-1} and latent heat of ice, $L = 3.36 \times 10^5$ J kg^{-1}, one atmosphere = 10^5 Nm^{-2}.

12. The Van der Waals constant for hydrogen are a = 0.02 47 Nm^4 mol^{-2}, $b = 2.65 \times 10^{-5}$ m^3 mol^{-1}. R = 8.31 J mol^{-1} K^{-1}. Find the inversion temperature of hydrogen.

13. Calculate the expected fringe shift in Michelson-Morley experiment. If the effective length of each path is 6 m, velocity of the earth round the sun is 3×10^4 ms^{-1} and wave length of monochromatic light used is 5000Å (Velocity of light is 3×10^8 ms^{-1}).

14. Calculate the velocity at which the mass of the electron is $\sqrt{3}$ times its rest mass. (Velocity of light is 3×10^8 ms^{-1}).

15. Calculate the moment of inertia of a uniform disc of mass 0.2 kg and radius 0.05 m about an axis passing through its edge and perpendicular to the plane of the disc.

16. The equation of a progressive wave is $y = 4 \sin 2\pi \left[\frac{t}{0.02} - \frac{x}{400} \right]$ metre. Find its amplitude and velocity.

PART – C

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

17. a) What should be the time period of a simple pendulum in a freely falling lift ? Explain.

    b) Justify the statement that Poissons ratio cannot be negative.

    c) The melting point of ice decreases and that of wax increases with an increase in pressure. Explain.

    d) Ideal gas does not show Joule-Thomson effect. Why ?

    e) Ether was assigned self contradictory properties. Explain.

    f) Moving clock runs slow. Explain.

    g) There are two spheres of same mass and same radius. One is solid and the other is hollow. Which of them has a larger moment of inertia about an axis through the diameter.

    h) Which properties of the medium are necessary for the propagation of a mechanical wave through it ?
