**SE – 150**

## II Semester B.Sc. Examination, September 2020
## (CBCS) (Fresh + Repeaters)
## (2016-17 and Onwards)
## PHYSICS – II
## Mechanics – 2, Heat and Thermodynamics – 2

Time : 3 Hours          Max. Marks : 70

**Instruction** : Programmable scientific calculators are **permitted**.

### PART – A

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

1. a) What is simple harmonic motion ? Give an example.

   b) Obtain an expression for the time period of oscillations of a simple pendulum for small amplitude.    **(2+6)**

2. a) What is single cantilever ?

   b) Derive an expression for the depression at the loaded end of a single cantilever.    **(1+7)**

3. a) Give the significance of thermodynamic potentials.

   b) Derive first and second 'T ds' relations.    **(2+6)**

4. a) What is first order phase transition ? Define the terms melting, vapourisation and sublimation.

   b) Obtain the condition of equilibrium of phases in terms of Gibb's potential. **(4+4)**

5. a) State the postulates of special theory of relativity.

   b) Obtain Lorentz transformation equations.    **(2+6)**

6. a) What is the inference of the negative result of Michelson Morley experiment ?

   b) Deduce Einstein – Mass energy relation $E = mc^2$ where symbols have their usual meaning.    **(2+6)**

**P.T.O.**

7. a) Define moment of inertia and radius of gyration.

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

8. a) Derive the equation of a progressive wave.

   b) Distinguish between group velocity and phase velocity and mention the relation between group velocity and phase velocity. **(5+3)**

## PART – B

Answer **any five** questions. **Each** question carries **four** marks. **(4×5=20)**

9. Calculate the total energy of simple harmonic oscillator of mass 0.03 kg having an amplitude 0.1 m and frequency of oscillation 20 Hz.

10. What is the force required to stretch a steel wire $1 \times 10^{-4}$ m² in cross section to increase the length by 10% ? Given Young's modulus, $= 2 \times 10^{11}$ Nm⁻².

11. Calculate the change in pressure to lower the melting point of ice by 1 K. Specific volume of ice at 273°K is $1.091 \times 10^{-3}$ m³ Kg⁻¹ and that of water at 273°K is $10^{-3}$ m³ Kg⁻¹. Latent heat of fusion of ice, L $= 3.36 \times 10^{5}$ J Kg⁻¹.

12. The Vander Waal's constants for hydrogen are a = 0.0247 Nm⁴ mol⁻¹, b = $2.65 \times 10^{-5}$ m³ mol⁻¹. R = 8.31 Jmol⁻¹ K⁻¹. Find the Joule-Thomson cooling for 5 atm fall of pressure, initial temperature being 100 K. Given 1 atm $= 10^{5}$ Nm⁻², Cp = 29 JK⁻¹mol⁻¹.

13. Calculate the expected fringe shift in Michelson Morley experiment, if the distance of each path is 2 m and light is of wavelength 6000 Å. Orbital velocity of the earth round the sun is $3 \times 10^{4}$ ms⁻¹. Velocity of light, c $= 3 \times 10^{8}$ ms⁻¹.

14. At what speed the mass of a particle will be double of its value at rest.

15. A fly wheel of mass 500 kg and diameter 2 m makes 600 revolutions per minute. Calculate moment of inertia and kinetic energy of fly wheel.

16. A string of length 1.2 m and mass $2 \times 10^{-3}$ is stretched by 4000 N. Calculate the velocity of waves on the string.

## PART – C

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

17. a) What is the relation between displacement and velocity of a body executing simple harmonic motion ?

 b) Which is more elastic, steel or rubber ? Explain.

 c) There is always cooling during an adiabatic expansion of a gas. Why ?

 d) What does Joule Thomson co-efficient imply if it is negative ? Explain.

 e) "Ether was assigned self contradictory properties". Justify.

 f) According to theory of relativity can massless particle exist ? Justify.

 g) Why is most of the mass concentrated at the rim in a fly-wheel ?

 h) "Sound waves travel faster in humid air than in dry air". Explain.