

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)

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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 $1 \times 10^{-4} \text{ m}^2$ in cross section to increase the length by 10% ? Given Young's modulus, $= 2 \times 10^{11} \text{ Nm}^{-2}$.
11. Calculate the change in pressure to lower the melting point of ice by 1 K. Specific volume of ice at 273 K is $1.091 \times 10^{-3} \text{ m}^3 \text{ Kg}^{-1}$ and that of water at 273°K is $10^{-3} \text{ m}^3 \text{ Kg}^{-1}$. Latent heat of fusion of ice, $L = 3.36 \times 10^5 \text{ J Kg}^{-1}$.
12. The Vander Waal's constants for hydrogen are $a = 0.0247 \text{ Nm}^4 \text{ mol}^{-1}$, $b = 2.65 \times 10^{-5} \text{ m}^3 \text{ mol}^{-1}$. $R = 8.31 \text{ Jmol}^{-1} \text{ K}^{-1}$. Find the Joule-Thomson cooling for 5 atm fall of pressure, initial temperature being 100 K. Given $1 \text{ atm} = 10^5 \text{ Nm}^{-2}$, $C_p = 29 \text{ JK}^{-1}\text{mol}^{-1}$.
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 $3 \times 10^4 \text{ ms}^{-1}$. Velocity of light, $c = 3 \times 10^8 \text{ ms}^{-1}$.
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 2×10^{-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.
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