



SM – 346

II Semester B.Sc. Examination, May/June 2018
(CBCS) (Fresh + Repeaters) (2016-2017 and Onwards)

PHYSICS – II

Mechanics – 2, Heat and Thermodynamics – 2



Time : 3 Hours

Max. Marks : 70

Instruction : Answer any five questions from each Part.

PART – A

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

1. a) Define simple harmonic motion.
b) Derive an expression for the time period of oscillations of a simple pendulum for small amplitude. (1+7)
2. a) What is a cantilever ?
b) Give the theory of single cantilever. (1+7)
3. Derive Maxwell's four thermodynamic relations from thermodynamical potentials. 8
4. Derive clausius clapeyron's latent heat equation. What is the effect of pressure on melting point of ice and boiling point of water ? 8
5. a) Distinguish between inertial and non-inertial frames of reference.
b) Describe Michelson-Morley experiment and discuss its result. (2+6)
6. a) State the postulates of special theory of relativity.
b) Deduce Einstein's mass-energy relation $E = mc^2$, where the symbols have their usual meaning. (2+6)

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7. a) Define moment of Inertia and radius of gyration.
b) State and prove parallel axes theorem for two dimensional case. (2+6)
8. a) Define group velocity and phase velocity.
b) Derive an expression for the speed of transverse waves on a uniform stretched string in terms of tension and mass per unit length. (2+6)

PART - B

Solve any five problems. Each problem carries four marks. (5×4=20)

9. A square lamina of side 0.30 m oscillates in a vertical plane about a horizontal axis perpendicular to its plane. Calculate the minimum time period of oscillations of compound pendulum. Given $K = \frac{L}{\sqrt{6}}$ and $g = 9.8 \text{ m/s}^2$.
10. Find the amount of work done in twisting a steel wire of radius 1 mm, length 0.25 m through an angle of 45° . Given the rigidity modulus for steel is $8 \times 10^{10} \text{ N/m}^2$.
11. Calculate the specific heat of saturated steam given that specific heat of water at $100^\circ\text{C} = 4242 \text{ JK}^{-1}$ and latent heat of vapourisation decreases with size in temp at the rate of 2688 JK^{-1} latent heat of vapourisation of steam = $540 \times 4200 \text{ JK}^{-1}$.
12. Calculate the change in temperature produced by adiabatic throttling process of one gram mole of oxygen when pressure reduced by 60 atmosphere. The initial temperature of the gas is 27°C . Given for oxygen $C_p = 29.53 \text{ JK}^{-1} \text{ mole}^{-1}$, $R = 8.3 \text{ JK}^{-1} \text{ mole}^{-1}$, $a = 0.132 \text{ Nm}^4 \text{ mole}^{-2}$, $b = 3.12 \times 10^{-5} \text{ m}^3 \text{ mole}^{-1}$.
13. At what speed the mass of the particle will be 1.25 times its rest mass? Given the velocity of light is $3 \times 10^8 \text{ m/s}$.
14. A π meson has mean life time of $2.2 \times 10^{-8} \text{ s}$ when measured at rest. How far does it travel before decaying into another particle if its speed is 0.99 C .
15. Calculate the angular momentum of a solid sphere of mass 5 kg and its radius 12 cm spinning at 12 revolutions per second.
16. A string of length 0.5 m and mass per unit length is $2 \times 10^{-4} \text{ kg/m}$ is stretched with a tension of 12 N. Calculate the velocity and frequency of fundamental note.

PART – C

Answer **any five** questions. **Each** question carries **two** marks.

(5×2=10)

17. a) In a simple harmonic motion, at which position P.E. and K.E. are maximum.
- b) Springs are made of copper or steel. Why ?
- c) Why C_p is greater than C_v ?
- d) Hydrogen and Helium shows negative Joule-Thomsons effect at room temperature. Explain.
- e) Name any two frame dependent forces.
- f) Is the moving clock go slow or fast ? Explain.
- g) What happens, when a man on turn table out stretches his hands suddenly ?
- h) Can sound waves be polarised. Explain.
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