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GS-297

II Semester B.Sc. Examination, May/June 2019

PHYSICS - II

Mechanics-2, Heat and Thermodynamics-2

(CBCS) (Fresh+Repeaters) (2016-17 and onwards)

Time : 3 Hours | Max. Marks : 70

Instruction : *Answer* ***any five*** *questions from each part.*

PART - A **5x8=40**

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

1. (a) Define simple harmonic motion giving an example. **2+6**

(b) What is Compound Pendulum ? Derive expression for its time period and equivalent length of simple pendulum.

2. (a) Define Young's modulus, rigidity modulus and Poisson's ratio. **3+5**

(b) Obtain an expression for work done in stretching a wire.

3. (a) What is Gibb's Free energy ?

(b) Write four Maxwell's thermodynamic relations and deduce an expression for difference in molar specific heats for perfect gas. **1+7**

4. (a) What is Joule-Thomson effect ? Derive an expression for Joule-Thomson co-efficient. **6+2**

(b) Write two differences between Joule-Thomson expansion and Adiabatic expansion.

5. (a) Distinguish between inertial and non inertial frames of reference. **2+6**

(b) What is Galilean invarience ? Show that the acceleration is invariant under Galilean transformations.

6. (a) What is the inference of negative result of Michelson-Morley experiment ? **2+6**

(b) Obtain an expression for Lorentz-Fitzgerald length contraction.

7. (a) State and explain law of conservation of angular momentum. **2+6**

(b) Derive an expression for moment of inertia of circular disc about an axis passing through its centre and perpendicular to its plane.

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8. (a) Define Phase velocity and Group velocity of waves. 2+6

(b) Derive the relation between Group velocity and Phase velocity of waves.

PART - B

Solve **any five** problems. Each problem carries **four** marks. 5x4=20

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

10. Poisson's ratio for glass is 0.4 and young's modulus is 2×10^{10} Nm^{-2}. Calculate the rigidity modulus of glass.

11. Calculate the depression in the melting point of ice for an increase of pressure of 2 atmospheres. Specific volume of ice and water at 273K are $1.091 \times 10^{-3} m^3 kg^{-1}$ and $10^{-3} m^3 kg^{-1}$ respectively. Latent heat of ice $= 336 \times 10^3$ $Jkg^{-1}K^{-1}$. 1 atmosphere $= 10^5$ Nm^{-2}.

12. Calculate the change in temperature when carbon dioxide gas suffers Joule-Thomson expansion at 300K when the pressure difference on the two sides of the porous plug being $5 \times 10^5 Nm^{-2}$.

Given $a = 0.303$ $Nm^4 mol^{-2}$

$b = 4.24 \times 10^{-5}$ $m^3 mol^{-1}$

$C_p = 36.57$ $Jmol^{-1}K^{-1}$

$R = 8.31$ $Jmol^{-1}K^{-1}$

13. Calculate the expected fringe shift in Michelson-Morley experiment if the distance of each path is 3m and light is of wavelength 6000 Å. Given orbital velocity of earth around the sun is 3×10^4 ms^{-1}. Velocity of light is 3×10^8 ms^{-1}.

14. An electron of rest mass 9.1×10^{-31} kg is moving with speed 0.99 C. What is its total energy ?

15. A solid sphere is of mass 2 kg and radius 0.5 m calculate its moment of inertia (a) about its diameter and (b) about an axis tangential to its surface.

16. The equation of a progressive wave is $y = \sin 2\pi \left[\frac{t}{0.02} - \frac{x}{400}\right]$ with length expressed in metre and time in second.

Find : (a) the wavelengths
(b) amplitude
(c) frequency and
(d) the velocity of the wave.

PART - C

Answer **any five** questions. Each question carries **two** marks. **5x2=10**

17. (a) Can simple pendulum experiment be done inside a satellite ? Explain.
(b) Why bridges are declared unsafe after long use ?
(c) There is always cooling during an adiabatic expansion of gas. Why ?
(d) What does Joule - Thomson co-efficient imply if it is negative ?
(e) Does the mass of a body vary with speed ? Explain.
(f) Is Newton II Law of motion F=ma always valid in relativity ? Explain.
(g) There are two spheres of the same mass and same radius. One is solid and the other is hollow. Which one of them has larger moment of inertia about diameter ? Explain.
(h) A Rope hangs vertically from the ceiling. DO waves on the rope move faster, slower or at same speed as they move from bottom to top.

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