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II Semester B.Sc. Degree Examination, September - 2021

PHYSICS

Mechanics - 2, Heat and Thermodynamics - 2

(CBCS Scheme Repeaters)

Paper - II

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

1. Answer any FIVE questions from each Part.
2. Candidate is permitted to use non-programmable Scientific Calculator.

PART - A

Answer any FIVE questions. Each question carries 8 Marks.

1. a) What are damped and undamped oscillations? (5×8=40)
b) Derive the second order differential equation for damped oscillations. (2+6)
2. a) What is meant by i) neutral surface and ii) bending moment? (2+6)
b) Obtain the expression for the time period of torsional oscillations.
3. a) Discuss the condition of equilibrium of phases in terms of Gibb's potential. (4+4)
b) Arrive at Clausius-Clapeyron latent heat equation.
4. a) What is liquefaction of gases? Mention any two methods of liquefying gases. (3+5)
b) With a labelled diagram, describe Claude's process of liquefaction of air.
5. Show that in Galilean relativity. (3+5)
i) velocity is variant, but ii) both acceleration and force are invariant.

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6. a) Write the Lorentz transformation equations. (4+4)
 b) Discuss Lorentz-Fitzgerald length contraction.
7. a) Explain radius of gyration of a body about an axis. (3+5)
 b) Derive the expression for the kinetic energy of a rotating rigid body.
8. a) What are mechanical waves? Why are they also called elastic waves? (2+6)
 b) Derive the equation for a progressive wave.

PART - B

Answer any FIVE questions. Each question carries 4 Marks. (5×4=20)

9. An object executes SHM with an amplitude of 0.17m and time period 0.84s. Determine its frequency, angular frequency and write the expression for its instantaneous displacement.
10. A steel wire of length 2m, diameter 2mm is stretched by a downward force. What mass is needed to stretch the wire by 1mm? Given young's modulus of steel is $20 \times 10^{10} \text{Nm}^{-2}$ and $g=10 \text{ms}^{-2}$.
11. Calculate the change in melting point of ice when it is subjected to a pressure of 100 atmospheres. Density of ice = 917kgm^{-3} , latent heat of ice = 336000Jkg^{-1} and 1 atmosphere = 10^5Nm^{-2} .
12. Find the change in temperature when He gas undergoes Joule-Thomson expansion at -10°C , the pressure difference between the two discs of the porous plug is 10 atmospheres. Given $R=8.3 \text{JK}^{-1} \text{mol}^{-1}$, $a=0.0341 \times 10^{-1} \text{Nm}^4 \text{mol}^{-2}$, $b=0.0237 \times 10^{-3} \text{m}^3 \text{mol}^{-1}$, $C_p=20.75 \text{JK}^{-1} \text{mol}^{-1}$ and 1 atmosphere = 10^5Nm^{-2} .
13. Find the fringe shift in Michelson-Morley experiment when the effective length of earth arm is 20m, orbital velocity of earth about the Sun is $3 \times 10^4 \text{ms}^{-1}$ and wave length of light used is 600nm.
14. What is the percentage increase in the mass of electron accelerated to a kinetic energy of 500MeV? Given: $m_0=9.1 \times 10^{-31} \text{kg}$.
15. Find the angular momentum of the earth assuming it to be a perfect sphere due to its rotation about its own axis. Given: Mass and radius of the earth respectively are $6 \times 10^{24} \text{kg}$ and $6.4 \times 10^6 \text{m}$.
16. A plane progressive wave is represented by $y=0.03 \sin(8500t-25x) \text{m}$. Find i) time period and ii) Phase difference between two points separated by a distance of 0.01m.



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PART - C

Answer any FIVE questions. Each question carries 2 Marks.

(5×2=10)

17. a) A girl is swinging on a swing in sitting position. Suppose, she stands up, does the time period of the swing change. Explain.
- b) Distinguish between perfectly elastic and perfectly plastic bodies.
- c) Why does cooking take longer time on the top of Mount Everest than at the sea level? Clarify.
- d) What is critical temperature of a gas? Is it same for all gases?
- e) Is Newtonian second law of motion valid in Special theory of relativity? Explain.
- f) What is the time interval between two events occurred in space as recorded by a clock moving at the speed of light for a stationary observer on the earth? Explain.
- g) There are two circular plates of same mass but made of two different metals. Which one of them will have smaller moment of inertia about the axis passing through their diameter and why?
- h) How does the speed of sound in a gas depend on the temperature? Explain.

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