25I103 (Pages: 2) Name : .....

Reg. No : .....

FIRST SEMESTER M.Sc. INTEGRATED GEOLOGY DEGREE EXAMINATION, NOVEMBER 2025

(FYIP)

CC25UPHY1MNIP01 - PROPERTIES OF MATTER AND THERMODYNAMICS

(Physics - Minor Course)

(2025 Admission - Regular)

Time: 2.0 Hours Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)

Answer ***all*** questions. Each question carries 3 marks.

1. Define torque and explain how it is related to equilibrium conditions. [Level:2] [CO1]
2. Differentiate between center of mass and center of gravity with a suitable condition. [Level:2] [CO1]
3. Mention two differences between shear stress and tensile stress. [Level:2] [CO1]
4. If the velocity at each point in space in steady-state fluid flow is constant, how can a fluid particle accelerate? [Level:2] [CO2]
5. State the principle of an open-tube manometer. [Level:1] [CO2]
6. Illustrate first law of thermodynamics and expalin its physical significance. [Level:3] [CO3]
7. Define work in thermodynamic process. [Level:2] [CO3]
8. Illustrate examples for reversible and irreversible process. [Level:2] [CO5]
9. Define entropy. Explain its physical significance. [Level:2] [CO5]
10. Define Otto cycle of internal combustion engine. [Level:2] [CO5]

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

Answer ***all*** questions. Each question carries 6 marks.

11. A pressure difference of $6.00 * 10^4$ Pa is required to maintain a volume flow rate of 0.800m3/s for a viscous fluid flowing through a section of cylindrical pipe that has radius 0.210 m. What pressure difference is required to maintain the same volume flow rate if the radius of the pipe is decreased to 0.0700 m? [Level:3] [CO2]
12. A balloon filled with helium gas has a total mass of 2 kg. If the volume of the balloon is 1.5 m^3, determine whether it will float in air (density of air = 1.29 kg/m^3). [Level:3] [CO2]

13. Describe the change in internal energy for different thermodynamic process. [Level:2] [CO3]

14. Differentiate between work done during isobaric, Isochoric, and isothermal process. [Level:2] [CO3]

15. Describe the first law of thermodynamics for a closed system undergoing change of state. Show that energy is a property of system. [Level:2] [CO3]

16. Illustrate $P V^{\gamma}$ = constant [Level:2] [CO4]

17. Initially 5.00 mol of neon gas (CV = 3 /2R and g = 5/ 2R) are at absolute temperature 305 K and occupy volume 4.00 * 10^{-2} m3. Then the gas expands adiabatically to a new volume of 9.00 * 10^{-2} m3 . Calculate (a) the initial pressure of the gas, (b) the final pressure of the gas, (c) the final temperature of the gas, and (d) the work done by the gas as it expands. [Level:3] [CO3]

18. A typical dorm room or bedroom contains about 2500 moles of air. Find the change in the internal energy of this much air when it is cooled from 35.0°C to 26.0°C at a constant pressure of 1.00 atm. Treat the air as an ideal gas with g = 1.400. [Level:3] [CO4]

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any ***one*** question. The question carries 10 marks.

19. Draw and explain the complete stress–strain curve for a ductile material. Mark the proportional limit, elastic limit, plastic region, and fracture point. [Level:2] [CO1]

20. Explain the Diesel cycle with the help of P-V diagrams. Derive the expression for air standard efficiency mean effective pressure. [Level:2] [CO5]

(1 × 10 = 10 Marks)

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