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D1BPH2502

Name: .....

Reg. No.: .....

FIRST SEMESTER FYUGP EXAMINATION NOVEMBER 2025

(Regular/Improvement/Supplementary)

MINOR

PHY1MN102: PROPERTIES OF MATTER AND THERMODYNAMICS

Time : 2 Hrs. **Maximum Marks : 70**

M – Mark BL - Bloom's Taxonomy Level (1 to 6) CO - Course Outcome

Section A: Answer all questions. Each carries 3 marks.

Ceiling: 24 Marks

No.	Question	M	BL	CO
1.	Define centre of gravity. How can we find the centre of gravity of an object?	3	2	CO1
2.	What are elastic and plastic bodies? Explain.	3	4	CO1
3.	Find the volume strain in a metal sphere of Bulk modulus 1.8× 108 N/m^2 when subjected to pressure of 2× 107 N/m2.	3	3	CO1
4.	A quantity of ideal gas undergoes an expansion that doubles its volume. Does the gas do more work on its surroundings if the expansion is at: (i) Constant pressure. (ii) constant temperature.	3	4	CO4
5.	Using a schematic, explain how three thermodynamic systems A, B, and C can achieve thermal equilibrium when placed together with both insulating and conducting walls.	3	5	CO4
6.	What are the standard sign conventions for heat and work in thermodynamics?	3	2	CO4
7.	A camper pours 0.300 kg of coffee, initially in a pot at 70.0°C, into a 0.120 kg aluminum cup initially at 20.0°C. what is the sign of Q for the coffee? For the aluminum cup?	3	3	CO4
8.	For the following processes, is the work done by the system (defined as the expanding or contracting gas) on the environment positive or negative? (a) expansion of the burned gasoline–air mixture in the cylinder of an automobile engine; (b) opening a bottle of champagne; (c) filling a scuba tank with compressed air; (d) partial crumpling of a sealed, empty water bottle as you drive from the mountains down to sea level.	3	4	CO5
9.	What factors influence the efficiency of a Carnot engine, and why is it impossible to achieve 100% efficiency in the Carnot cycle?	3	1	CO5
10.	How does the Carnot cycle allow heat transfer without a temperature difference? **(PTO)**	3	3	CO5

Section B: Answer all questions. Each carries 6 marks. Ceiling: 36 Marks				
No.	**Question**	**M**	**BL**	**CO**
11.	Describe the steps involved in solving rigid body equilibrium problems using the conditions of equilibrium. Include a detailed explanation of how to apply the concepts of force analysis and torque analysis in determining the equilibrium of a rigid body.	6	3	CO1
12.	Define density and explain how hydrometer is used to calculate the density of liquids.	6	2	CO2
13.	Water enters a horizontal pipe of non-uniform cross-section with a velocity of 0.6m/s and leaves the other end with a velocity of 0.4m/s. At the first end, pressure of water is $1600N/m^2$. Calculate the pressure of water at the other end. Density of water = 1000 kg/m^3.	6	3	CO2
14.	A gas undergoes two processes. In the first, the volume remains constant at 0.200 m^3 and the pressure increases from 2.00 X 10^5 Pa to 5.00 X 10^5 Pa. The second process is a compression to a volume of 0.120 m^3 at a constant pressure of 5.00 X 10^5 Pa. (a) In a PV-diagram, show both processes. (b) Find the total work done by the gas during both processes.	6	5	CO4
15.	With the help of a PV-diagram, show that work done is a path function.	6	5	CO4
16.	With the help of a schematic diagram, explain the working of a practical refrigerator.	6	4	CO5
17.	A diesel engine has efficiency 0.180. (a) In order for this engine to do 1.24 X 10^4 J of work, how many joules of heat must it take in? (b) How many joules of this heat is discarded?	6	5	CO5
18.	A Carnot engine performs 1.24 X 10^4 J of work in each cycle and has an efficiency of 66%. (a) How much heat does the engine extract from its heat source in each cycle? (b) If the engine exhausts heat at room temperature (20.0°C), what is the temperature of its heat source?	6	5	CO5
Section C: Answer any one question. Each carries 10 marks. (1 x 10 = 10 Marks)				
No.	**Question**	**M**	**BL**	**CO**
19.	State and explain Hooke's law. Explain the typical stress and strain graph of a metallic wire.	10	2	CO1
20.	What are the four fundamental thermodynamic process? Give one example each. Write down the expression for first law of thermodynamics in each case. Derive the expression for gas equation and work done during an adiabatic process .	10	2	CO5