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SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION APRIL 2025

(PHYSICS)

PHY2MN105 Fluid Mechanics and Thermodynamics

2024 Admission onwards

Maximum Time :2 Hours	Maximum Marks :70

Section A

All Questions can be answered. Each Question carries 3 marks (Ceiling : 24 Marks)

1	Distinguish between density and relative density of a substance. What is the density of Copper in SI units if its relative density is 8.9?
2	State Pascal's law. Using this law, explain the working of a hydraulic lift.
3	State and explain Zeroth law of thermodynamics.
4	Briefly explain the different modes of transfer of heat.
5	State the Stefan-Boltzmann law.
6	What is the principle of a constant-volume gas thermometer?
7	Distinguish between isochoric and adiabatic processes.
8	Define internal energy of a system. How is the internal energy of an ideal gas different from that of a real gas?
9	What is meant by heat capacity of an ideal gas? Write the relation connecting C_p and C_V for an ideal gas, where the symbols have their usual meanings.
10	Define entropy. How is it related to randomness?

Section B

All Questions can be answered. Each Question carries 6 marks (Ceiling : 36 Marks)

11	Derive the continuity equation for the flow of an incompressible fluid. How does this equation get modified for a compressible fluid?
12	(i) Distinguish between absolute pressure and gauge pressure. (ii) Water stands 12.0 m deep in a storage tank whose top is open to the atmosphere. What are the absolute and gauge pressures at the bottom of the tank?

13	A surveyor uses a steel measuring tape that is exactly 50.000 m long at a temperature of 20°C. What will be the length of the tape when the temperature is increased to 35°C? Given: Coefficient of linear expansion of steel = 1.5 x 10-5K-1
14	Derive an expression for the work done during volume change of a system. Draw the pV diagram for a system undergoing an expansion with varying pressure and explain how the work done is calculated from it.
15	An ideal gas of volume 1 litre and at a pressure of 6 atm expands adiabatically till the pressure is reduced to one third of its initial value. If the ratio of heat capacities = 1.4 for the gas and 1 atm = 1.013 x 105N/m 2, calculate the new volume and the work done during expansion.
16	Give the Kelvin-Planck and Clausius statements of the second law of thermodynamics. Show that these statements are completely equivalent.
17	A room contains about 2500 moles of air. Find the change in internal energy of this much air when it is cooled from 35.0°C to 26.0°C at a constant pressure of 1 atm. Treat the air as an ideal gas with ratio of heat capacities = 1.40
18	A Carnot engine operating between 500 K and 300 K absorbs 1500 J from the source. Calculate the efficiency of the engine, heat rejected to 300 K reservoir and the work per cycle.
Section C	
Answer any ONE. Each Question carries 10 marks (1x10=10 Marks)	
19	With necessary theory, derive the Bernoulli's equation. Use the equation to explain the lift on an airplane wing.
20	a) Draw the energy flow diagram of a heat engine and obtain a mathematical expression for the thermal efficiency of the engine. b) Prove that 'no engine can be more efficient than a Carnot engine operating between the same two temperatures'