VIT

Vellore Institute of Technology

Continuous Assessment Test (CAT - I), August 2024

Programme	:	B.Tech	Semester	:	Fall 2024-2025
Course Title	:	Modern Physics	Course Code	:	PHY1005
School	:	School of Advanced Sciences	Slot	:	D1+TD1
Duration	:	90 mins	Max. Marks	:	50
Class No	:	6073, 6075			

Part – A (5 x 10 = 50)

Answer ALL Questions

Sl. No	Questions	Max Marks
1	Show that for an ideal gas $c_p - c_v = R$, where R is the universal gas constant, c_p and c_v are molar specific heat capacity at constant pressure and at constant volume respectively. Also show that for adiabatic process, PV^γ=constant. where $\gamma = c_p/c_v$.	10
2	Explain the concept of Carnot's cycle. Obtain the expression for the efficiency of Carnot's cycle in terms of temperatures of the source and sink.	10
3	(a) Explain the concept of entropy. How it relates to the third law of thermodynamics?	5
	(b) A Carnot engine has an efficiency of 60% when its source temperature is at 727° C. Calculate the percentage change in the sink temperature (in Kelvin) for increasing its efficiency to 70%.	5
4	Obtain the general equation for the charge oscillation in a LCR circuit. Also, discuss its solution and the behavior of the system under different damping conditions.	10
5	(a) Show that the total energy of a particle in a SHM is independent of time, also show the variation of the kinetic and the potential energy with time.	5
	(b) Calculate the amplitude, angular frequency, frequency, time period and the initial phase for a simple harmonic oscillation given by, $x = 1.5 \sin [(5t - 1)\pi]$ meter. What will be the speed and acceleration of the particle at x = 1.0 m?	5