

**VIT**Vellore Institute of Technology
Chennai

Reg. Number: 23BHE1020

Continuous Assessment Test (CAT) – I - FEB 2024

Programme	: B. Tech.	Semester	: Win 2023-24
Course Code & Course Title	: BPHY101L/ Engineering Physics	Class Number(s)	: CH2023240500424 CH2023240500447 CH2023240500434 CH2023240500441 CH2023240500450 CH2023240503038
Faculty	: Atanu Dutta, Caroline Ponraj, R D Eithiraj, N Manikandan, M C Ramkumar, G Vinitha	Slot	: B1 + TB1
Duration	: 90 Minutes	Max. Mark	: 50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted

Answer all questions (2 x 15 = 30 Marks)

1.	Consider a string is fixed at both ends. What will happen when it is plucked? Derive the associated equation of such a wave. Calculate the Eigen frequency for the second harmonic of the wave, if the string has a length of 3 m.	2+ 10 +3
2.	Derive the plane electromagnetic wave equation in a medium in terms of both electric & magnetic fields. Show that light is an EM wave, when medium is replaced with vacuum.	12 +3

Answer any 2 questions (2 x 10 = 20 Marks)

3.	(i) You are given a copper wire with tension of 20 N/m in which the longitudinal waves are propagating at a speed of 15 m/s. If you want to increase the speed of that wave to 45 m/s, what should be the tension with which the string has to be held? (ii) Consider that strings of 2 alloys which vary slightly in their linear mass densities are connected at a point and are maintained at a constant tension 'F'. If a wave is generated at one end of the string, discuss what will happen to its propagation at the point where the strings are connected. Write down the equations corresponding to the phenomena occurring at the interface along with that of reflection and transmission coefficients. Also, discuss what will happen if the impedance of second string becomes infinite.	2+ 8
4.	(i) Show that the curl of the gradient of a function $F = 5x^2 + 3y^3 + 2z$ is zero. (ii) Describe the experiment that proves the propagation of EM waves.	4+ 6
5.	(i) The displacement of a plane progressive wave is represented by the equation $y = 0.6 (m) \sin(50\pi t - 10\pi x/3)$, where x is the distance from a fixed origin O. Calculate (a) wavelength (b) speed of the wave and (c) maximum vertical displacement of the wave. (ii) Find the divergence and curl of the following function: $\mathbf{y}_1 = 2xy\mathbf{i} + 3yx^2\mathbf{j} + y^2z\mathbf{k}$	6+ 4