VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test (CAT - I), March 2022

Programme	:	**B.Tech**	Semester	:	**Winter 2021-22**
Course Title	:	**Engineering Physics**	Course Code	:	**BPHY101L**
School	:	**School of Advanced Sciences**	Slot	:	**D1+TD2**
Duration	:	**50 mins + 10 mins for file upload**	Max. Marks	:	**30**
Faculty	:	**Dr. Sridhar S**			

Part – A (3 x 10 = 30)

Answer ALL Questions

Sl. No	Questions	Max. Marks	CO	BL
1	Derive the one dimensional wave equation for a wave travelling on a string with length 'L' and linear density 'ρ'. **(10 marks)** **(OR)** Obtain the general solution for the one dimensional wave equation $\frac{\partial^2 y}{\partial x^2} = \frac{1}{C^2}\frac{\partial^2 y}{\partial t^2}$. **(10 marks)** **(OR)** Derive the reflection coefficient for a wave travelling along the positive x direction when it encounters a rigid fixed end. **(10 marks)** **(OR)** Derive an expression for group velocity and plot the dispersion relation for normal and anomalous dispersion. **(10 marks)**	**10**	**CO1**	**L2**
2	Guitars have strings of different linear mass density. If the lowest density string and the highest density string are under the same tension, which string would support waves with the higher wave speed? **(5 marks)** A sinusoidal transverse wave has a wavelength of 2.80 m. It takes 0.10 s for a portion of the string at a position x to move from a maximum position of y = 0.03 m to the equilibrium position y = 0. What are the period, frequency, and wave speed of the wave? **(5 marks)** **(OR)** If the tension in a string were increased by a factor of four, by what factor would the wave speed of a wave on the string increase? **(5 marks)**	**10**	**CO1**	**L3**

	A metal wire has a length of 10 m and a mass of 2.25 kg. What will be the speed of a transverse wave on this wire when a tension of 2.06 x 10^4 N is applied? **(5 marks)** **(OR)** An incident sinusoidal wave is sent along a string that is fixed to the wall with a wave speed of v. The wave reflects off the end of the string. Describe the reflected wave. **(5 marks)** Consider two sinusoidal waves traveling along a string, modeled as $y_1(x, t) = 0.3$ m $\sin(4\ m^{-1}\ x + 3\ s^{-1}\ t)$ and $y_2(x, t) = 0.6$ m $\sin(8\ m^{-1}\ x - 6\ s^{-1}\ t)$. What is the height of the resultant wave formed by the interference of the two waves at the position x = 0.5 m at time t = 0.2 s? **(5 marks)** **(OR)** A string of a constant linear mass density is held taut by two students, each holding one end. The tension in the string is constant. The students each send waves down the string by wiggling the string. (a) Is it possible for the waves to have different wave speeds? (b) Is it possible for the waves to have different frequencies? (c) Is it possible for the waves to have different wavelengths? **(5 marks)** A string of mass 2.5 kg is under tension of 200 N. The length of the stretched string is 20.0 m. If the transverse jerk is struck at one end of the string, calculate the time needed for the disturbance to reach the other end. **(5 marks)**			
3	Write down the Maxwell's equations in integral forms and write its significance. **(5 marks)** Find the irrrotational vector field from below: F = $3x^2$ i – 6xy j, and G = x i + y j +z k. **(5 marks)** **(OR)** Write down the physical significance of gradient, divergence and curl. **(5 marks)** Find the solenoidal vector field from below: F = $3x^2$ i – 6xy j, and G = x i + y j +z k. **(5 marks)** **(OR)** Using Maxwell's Equations prove that light is in fact an electromagnetic wave. **(5 marks)** Find the electric flux through the surface of a sphere containing 15 protons and 20 electrons. Does the size of the sphere influence the net electric flux? **(5 marks)** **(OR)**	**10**	**CO1**	**L5**

	Write a note on Maxwell's contribution to Ampere's law and discuss its significance. **(5 marks)** Show that the standing wave f (x,t) = A Sin (kx). Cos (kυt) satisfies the wave equation. **(5 marks)**			