



# VIT

Vellore Institute of Technology  
(Deemed to be University under section 3 of U.G.C Act, 1956)

## Continuous Assessment Test (CAT - 1), February 2024

|              |   |             |                    |
|--------------|---|-------------|--------------------|
| Programme    | : B.Tech.   | Semester    | : Winter 2023-2024 |
| Course Title | : Engineering Physics   | Course Code | : BPHY101L         |
| School       | : School of Advanced Sciences                                 | Slot        | : D1+TD1           |
| Duration     | : 90 mins   | Max. Marks  | : 50               |
| Class No     | : 1901/1895/1902/1892/1899/1894/1891/1893/4393/1897/1896/1900 |             |                    |

Part – A (5 × 10 = 50)

Answer ALL Questions

| Sl. No | Questions  | Max Marks | CO  | BL |
|--------|--|-----------|-----|----|
| 1      | Derive the classical wave equation for a one-dimensional traveling wave excited on a string under constant tension $T$ with a clear and well labelled diagram.   | 10        | CO1 | L2 |
| 2      | Obtain the wave function for a stationary wave produced on a string of length $L$ , fixed at both the ends (nodes), and by applying suitable boundary conditions derive the expression for frequency of first three harmonics and sketch the wave patterns.  | 10        | CO1 | L3 |
| 3      | a) Calculate the Reflection ( $R$ ) and Transmission ( $T$ ) coefficients of a wave travelling on two strings joined together with a massless knot under same tension but of different linear densities ( $\mu_1$ and $\mu_2$ ), when speed of wave in first string ( $v_1$ ) is double that on the second string, using related equations. Also draw the incident, reflected and transmitted waves.<br>b) A long string of linear density 10 g/cm is joined to another long string of linear density 40 g/cm and the combination is held under constant tension. A transverse sinusoidal wave of amplitude 30 cm and wavelength 250 cm is launched along the lighter string. Calculate the wavelength and amplitude of the wave when it is travelling along the heavier string. | 5<br>5    | CO1 | L4 |
| 4      | Show that light is an electromagnetic wave that travels with speed $c$ ( $3 \times 10^8$ m/s) in free space. Further, starting with a traveling $E$ -wave ( $E_y = E_0 \sin(kz - \omega t)$ ), obtain the expression for the corresponding $B$ -wave.  | 10        | CO1 | L2 |
| 5      | a) Explain the physical significance of divergence of a vector ( $\nabla \cdot A$ ) and curl of a vector ( $\nabla \times A$ ). Further, comment on their appropriate use in Maxwell's equations.<br>b) An electromagnetic wave traveling with velocity of light has an electric field $E_z = 100 \sin(80y + \omega t)$ . Find its wavelength ( $\lambda$ ), angular frequency ( $\omega$ ), direction of propagation and expression of magnetic field, $B$ .  | 5<br>5    | CO1 | L4 |