

**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)**Continuous Assessment Test – II**

Programme Name & Branch: B. Tech

Course Name & Code: PHY1701 Engineering Physics

Slot: C2+TC2

Exam Duration: 1½ hours

Maximum Marks: 50

**General instruction(s):**

Only class notes are permitted.

Section – A (10 x 5 = 50 Marks)

1. For a laser emitting a wavelength of λ (or frequency ν) and bandwidth $\Delta\lambda$ (or $\Delta\nu$), show that the coherence length can be expressed either as $\lambda^2/\Delta\lambda$ or $c/\Delta\nu$. For a source with an emission bandwidth of $\Delta\nu = 3 \times 10^6$ Hz, calculate the coherence length. [4+1]
2. A 4-level pumping scheme operating at room temperature is proposed as per the diagram given below. Do you expect any gain from the system? Explain your answer.
3. Consider a two-level laser proposed to be implemented with optical pumping. Under thermal equilibrium, show that the population of the upper level can never exceed the lower level.
4. Distinguish between the role of helium in (a) He-Ne laser and (b) CO₂ laser. [2+3]
5. In the energy level diagram of laser transitions, why does the y-axis typically have the dimensions of inverse length? If there is a transition from level 2349 cm⁻¹ to 1255 cm⁻¹, calculate the wavelength of emitted radiation. [3+2]
6. Obtain an expression for the electric field part of an EM wave travelling in z direction with an amplitude of 100 V cm⁻¹ and wavelength of 628 nm. Assume initial phase is zero and the wave is in free space.
7. Consider a flux of current \mathbf{J} out of a closed volume containing a charge density ρ . Show that $\nabla \cdot \mathbf{J} = -\frac{\partial \rho}{\partial t}$.
8. Can we have, under certain condition, electric field lines forming closed loops? Explain with an example.
9. Consider two electric fields that differ by frequency and wave number $\Delta\omega$ and Δk but with the same amplitude. Show that their superposition leads to a wave with group velocity $\Delta\omega/\Delta k$. [1+4]
10. Write the integral form of Faraday's law and explain its meaning. Why does the integration of the magnetic flux not reduce to zero? Is this not in contradiction with Gauss law for magnetostatics? Explain. [3+2]

JOIN
VIT QUESTION PAPERS
ON TELEGRAM