



VIT

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

REG.NO.:

SLOT: B1+TB1

SCHOOL OF ADVANCED SCIENCES
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2025-2026

Programme Name & Branch
Course Code and Course Name
Faculty Name(s)

: Integrated M.Tech - MIS

: IAPHY101L and Engineering Physics

: Prof. S P Vijayachamundeeswari, Dr. Joseph Nathanael A,
Dr. Sangem Rajesh, Dr. Kanhaiya Lal Pandey

Class Number(s)

Date of Examination

Exam Duration

: 5462, 5719, 5470, 5459

: 06/10/2025

: 90 minutes

Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO - Course Outcome; BL - Blooms Taxonomy Level (1 - Remember, 2 - Understand, 3 - Apply, 4 - Analyze, 5 - Evaluate, 6 - Create)
- Course Outcomes:
CO2: Apply quantum mechanical ideas to microscopic systems.
CO3: Examine the characteristics and working of lasers by applying the Einstein's theory of stimulated emission.
CO4: Describe the primary components of a typical optical fibre communications system and their working principles.

Q. No.	Question	M	CO	BL
1.	a) Define quantum confinement and briefly discuss how it affects the fundamental properties in nanomaterials. Also describe the classification of the nanostructures based on this principle.	5	CO2	BL3
	b) An electron with kinetic energy 9.00 eV is incident on a square potential barrier with height of 10.00 eV and width of 5 nm. Find its transmission probability.	5		
2.	Explain Einstein's theory of matter-radiation interaction. Describe the three fundamental processes involved in this context using suitable diagrams and derive the relations between Einstein's coefficients. Why is it easier to obtain lasing action in the infra-red (IR) region than in the ultraviolet (UV) region?	10	CO3	BL2
3.	What is a four-level Laser? Justify why a three-level laser usually provides pulsed output compared to a four-level laser. Hence, with a suitable schematic and energy level diagram, explain the construction and working principle of a four-level solid-state Laser.	10	CO3	BL2
4.	a) Show that for a system of atoms and photons in equilibrium at a temperature T, the ratio of the transition rates of stimulated emission to spontaneous emission is given by $\frac{1}{e^{\frac{h\nu}{k_B T} - 1}}$	5	CO3	BL3



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	b) Calculate the value of threshold gain coefficient of the laser with cavity length $500 \mu\text{m}$ and loss coefficient $10/\text{cm}$. The value of reflectance R_1 is 0.998 and R_2 is 0.950 .	5		
5.	a) Draw a ray diagram for the propagation of light through an optical fibre and derive the expression for the numerical aperture.	5	CO4	BL3
	b) The refractive index of the core of a step index fibre is 1.63 , and the critical angle at the core-cladding interface is 75° , determine the acceptance angle if the outer medium is air $n_0=1.00$.	5		
