PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY/ JUNE 2025

Date: 02-06-2025   **Time:** 01:00 pm – 04:00 pm

School: SOE	**Program:** B. Tech-ECE/VLSI Design and Technology
Course Code: ECE3021	**Course Name:** Optoelectronic Materials
Semester: IV	**Max Marks**: 100 **Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	19	19	41	21	-

Instructions:

   (i) Read all questions carefully and answer accordingly.

   (ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.   **10Q x 2M=20M**

1.	Compare crystal and lattice.	2 Marks	L1	CO1
2.	Define a unit cell and mention its types.	2 Marks	L1	CO1
3.	Compare coherent and non-coherent sources in interference.	2 Marks	L1	CO2
4.	State Wien's displacement law.	2 Marks	L1	CO2
5.	What is an active medium in a laser?	2 Marks	L1	CO3
6.	Compare LED vs. LASER.	2 Marks	L1	CO3
7.	Define population inversion.	2 Marks	L1	CO3
8.	Represent the mathematical expression for the Fermi-Dirac distribution.	2 Marks	L1	CO4
9.	Represent the output voltage relationship of the buck converter.	2 Marks	L1	CO4
10.	List any two applications for DC-to-DC converters.	2 Marks	L1	CO4

Part B

Answer the Questions.   **Total Marks 80M**

11.	a.	Write short notes on the following thermal detectors (i) Thermoelectric Detectors (ii) Bolometer (iii) Pneumatic Detectors	20 Marks	L3	CO3

		(iv) Pyroelectric Detectors			
		Or			
12.	**a.**	Light (Photons) is a mysterious phenomenon that can behave like a wave or a particle, depending on how we observe it. Illustrate with an experiment how light and matter can display characteristics of both classically defined waves and particles, along with conditions for sustained interference.	**20 Marks**	**L3**	**CO3**
13.	**a.**	Electrical conductivity in solids measures how easily electric current can pass through a substance. Derive an expression for the electrical conductivity of solids using Newton's law of motion.	**15 Marks**	**L2**	**CO 1**
		Or			
14.	**a.**	Capacitance-voltage (C-V) characterization is used to analyze the electrical properties of dielectric materials, particularly in semiconductor devices like MOS capacitors. Explain the C-V characteristics of MOSFET in detail, along with different modes of operation.	**15 Marks**	**L2**	**CO 1**
15.	**a.**	Derive and explain the equation in quantum mechanics, allowing us to find the wave function for a given situation and describe its time-independent equation.	**15 Marks**	**L2**	**CO 2**
		Or			
16.	**a.**	Explain in detail how the PN junction diode behaves under different bias conditions, with its characteristics.	**15 Marks**	**L2**	**CO 2**
17.	**a.**	Identify the optical instrument that emits through an optical amplification process based on the controlled discharge of electromagnetic radiation. which generates a very narrow and dense light beam and explain its principle, construction, working, and applications with a neat diagram.	**15 Marks**	**L2**	**CO 3**
		Or			
18.	**a.**	Explain the following photomultiplier configurations with their advantages (i) Venetian blind (ii) Box/grid (iii) Linear focused **(iv)** Circular edge focused	**15 Marks**	**L2**	**CO 3**
19.	**a.**	A liquid crystal display (LCD) is a flat, thin display device that leverages technology to provide better picture quality. Explain LCD's working principle, construction, and working and compare it with light emitting diodes.	**15 Marks**	**L2**	**CO 4**
		Or			
20.	**a.**	Identify the type of DC-to-DC converter with an output voltage magnitude that is either greater or less than the input voltage magnitude. Justify with a real-time example.	**15 Marks**	**L2**	**CO 4**