Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 29-05-2025 **Time:** 01:00 pm – 04:00 pm

School: SOE	**Program:** B. Tech Physics Cycle	
Course Code: PHY1002	**Course Name:** Optoelectronics and Device Physics	
Semester: II	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	26	24	24	26	

Instructions:

(i) Read all questions carefully and answer accordingly.

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

(iii) Given : $h = 6.625\times10^{-34}$ Js; $e = 1.6\times10^{-19}$ C; $K = 1.38\times10^{-23}$; Jk-1; $c = 3\times10^{8}$ m/s

Part A

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

1.	Define superconductivity.	**2 Marks**	**L1**	**CO1**
2.	How to form P-Type and N-type Semiconductors?	**2 Marks**	**L1**	**CO1**
3.	Mention any two applications of the Hall effect.	**2 Marks**	**L1**	**CO1**
4.	Mention any two applications of the LED.	**2 Marks**	**L1**	**CO2**
5.	Write any two differences between LED and SOLAR CELL.	**2 Marks**	**L1**	**CO2**
6.	What is a blackbody?	**2 Marks**	**L1**	**CO3**
7.	Write the expression for Schrödinger's time-independent wave equation.	**2 Marks**	**L1**	**CO3**
8.	What are the characteristics of LASER?	**2 Marks**	**L1**	**CO4**
9.	Define Numerical Aperture.	**2 Marks**	**L1**	**CO4**
10.	Define Acceptance angle.	**2 Marks**	**L1**	**CO4**

Part B

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

11.	**a.**	Distinguish between Conductor, Semiconductor, and Insulator with suitable energy band diagrams.	**10 Marks**	**L2**	**CO1**
	b.	C, Sn, Si, and Ge are present in the same group, but Si and Ge are semiconductors while C and Sn are not. State the reasons. (C-Band gap-5.2 eV, Si-Band gap-1.1 eV, Ge-Bandgap-0.7 eV, Sn-Energy band-0 eV).	**5 Marks**	**L3**	**CO1**
	c.	Estimate the fraction of electrons in the conduction band at 300K of (a) Germanium (E_g= 0.72 eV) (b) Silicon (E_g=1.1 eV)	**5 Marks**	**L3**	**CO1**
		Or			
12.	**a.**	Distinguish between Type-I and Type-II superconductors.	**5 Marks**	**L2**	**CO1**
	b.	Explain the Hall effect with the help of a neat diagram. Mention the significance of Hall coefficient.	**10 Marks**	**L2**	**CO1**
	c.	Calculate the Hall voltage when a conductor carrying a current of 100 A, is placed in a magnetic field of 1.5 T. The conductor has a thickness of 1 cm, and the number density of charges inside the conductor is $5.9 \times 10^{28}/m^3$.	**5 Marks**	**L3**	**CO1**

13.	**a.**	Distinguish between PN junction Diode and Zener Diode	**5 Marks**	**L2**	**CO2**
	b.	Explain the Principle, construction, and working of a solar cell with a neat diagram.	**10 Marks**	**L2**	**CO2**
	c.	A single solar cell (10 cm × 10 cm) produces a voltage of 0.5 V and a current up to 2.5 A. If the solar intensity is 800 W/m^2, find out the efficiency of the solar cell.	**5 Marks**	**L3**	**CO2**
		Or			
14.	**a.**	Distinguish between Zener Breakdown and Avalanche Breakdown	**5 Marks**	**L2**	**CO2**
	b.	Explain the principle, construction, and working of a LED with neat diagrams.	**10 Marks**	**L2**	**CO2**
	c.	Gallium Arsenide (GaAs) LED has a band gap of 1.5 eV. Calculate the wavelength of light emitted by the LED.	**5 Marks**	**L3**	**CO2**

15.	**a.**	What are the characteristic properties of matter waves?	**6 Marks**	**L2**	**CO3**
	b.	Calculate the momentum of an electron and the de Broglie wavelength associated with it if its kinetic energy is 1.5 KeV.	**7 Marks**	**L3**	**CO3**

	c.	Compare the energy of a photon with that of a neutron when both are associated with a de Broglie wavelength of 1 Å. Given mass of neutron is 1.674×10^{-27} kg	**7Marks**	**L3**	**CO3**
		Or			
16.	**a.**	What are the properties of a wavefunction?	**6 Marks**	**L2**	**CO3**
	b.	The position and momentum of a 10 keV electron are determined simultaneously. If its position is located within 1 Å, what is the percentage uncertainty in its momentum?	**7 Marks**	**L3**	**CO3**
	c.	A particle of mass m = 9.11×10^{-31} kg (mass of an electron) is confined in a one-dimensional box of length L = 1.0×10^{-9} m. Calculate the energy of the particle in the first three quantum states (n=1,2,3). Find the energy difference between the first and second energy levels.	**7 Marks**	**L3**	**CO3**

17.	**a.**	Explain stimulated absorption, Spontaneous and Stimulated emission of radiation with the help of a neat diagram.	**10 Marks**	**L2**	**CO4**
	b.	Explain the conditions for LASER with a neat diagram.	**5 Marks**	**L2**	**CO4**
	c.	The ratio of the population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted at 330 K.	**5 Marks**	**L3**	**CO4**
		Or			
18.	**a.**	Explain the principle of an optical fiber with a neat diagram.	**5 Marks**	**L2**	**CO4**
	b.	Identify the high band width cable which is used in communication system. Explain the communication process from transmitter to receiver with block diagram.	**10 Marks**	**L3**	**CO4**
	c.	Calculate the numerical aperture and acceptance angle in an optical fibre. Refractive indices of core and cladding are respectively 1.41 and 1.4. Wavelength of laser used is 820 n m.	**5 Marks**	**L3**	**CO4**