Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – March 2026

Date: 13- 03-2026 **Time:**11.45am to 01.15pm

School: SOE	**Program:** B.Tech. (VLSI)	
Course Code: ECE2509	**Course Name:** Solid State Electronics	
Semester: IV	**Max Marks:** 50	**Weightage:** 25%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	14	19	17	-	-

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. **5Q x 2M=10M**

1	List the differences between pure, intrinsic and extrinsic semiconductor.	**2 Marks**	**L1**	**CO1**
2	What are the two conditions that needs to be satisfied if the semiconductor is in thermal equilibrium?	**2 Marks**	**L2**	**CO1**
3	Define mean free path.	**2 Marks**	**L1**	**CO2**
4	In gallium arsenide, if the concentration of electrons at thermal equilibrium is 5×10^{18} cm^{-3}, then find the concentration of holes.	**2 Marks**	**L2**	**CO2**
5	Draw the I-V characteristics of a practical p-n junction diode in both forward and reverse bias condition.	**2 Marks**	**L1**	**CO3**

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	Explain the concept of the Fermi level in a semiconductor with appropriate energy band diagrams for intrinsic and extrinsic semiconductors. Also discuss the effect of temperature on the position of the Fermi level.	**10 Marks**	**L2**	**CO1**

		Or			
7.	**a.**	With appropriate diagrams, discuss the temperature dependence of carrier concentrations in intrinsic and extrinsic semiconductors in all three regions.	**10 Marks**	**L2**	**CO1**

8.	**a.**	Explain the behavior of excess carriers in semiconductors. Describe the concept of quasi-Fermi levels.	**5 Marks**	**L2**	**CO2**
	b.	Explain the Hall Effect and discuss its importance in determining semiconductor parameters such as carrier concentration and mobility.	**10 Marks**	**L2**	**CO2**
		Or			
9.	**a.**	Explain the difference between thermal generation, optical generation, direct recombination, and trap-assisted recombination.	**5 Marks**	**L2**	**CO2**
	b.	Explain generation and recombination of carriers in semiconductors. Define carrier lifetime and derive the continuity equation.	**10 Marks**	**L2**	**CO2**

10.	**a.**	A germanium p-n junction diode operates at 300 K with a reverse saturation current of 10 nA. Calculate the forward current at 0.7 V forward bias. The Boltzmann constant is 8.6×10^{-5} eV/K, and ideality factor is 1.	**5 Marks**	**L3**	**CO3**
	b.	Draw the energy band diagrams of a p-n junction under all three biasing conditions with proper labelling of fermi level, conduction band edge and valence band edge. Explain the barrier lowering or increasing in each case.	**10 Marks**	**L2**	**CO3**
		Or			
11.	**a.**	A p-n junction has an acceptor concentration of 10^{16} cm^{-3} on the p-side and a donor concentration of 10^{15} cm^{-3} on the n-side. Calculate the contact potential at 300 K. Given: $n_i = 1.5 \times 10^{10}$ cm^{-3}, Boltzmann constant is 1.3×10^{-23} $m^2kgs^{-2}K^{-1}$, and charge is 1.6×10^{-19} C.	**5 Marks**	**L3**	**CO3**
	b.	Explain the reverse-bias breakdown mechanisms in p-n junctions with appropriate diagrams.	**10 Marks**	**L2**	**CO3**