Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 70061

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. / FEB. 2026
Second Semester
Electronics and Communication Engineering
U23EC201– SEMICONDUCTOR DEVICES AND TECHNOLOGY
(Regulation 2023)

Time: Three Hours | Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	How would you apply the concept of the Fermi level to explain the electrical conductivity of different materials?	2	K2	CO1
2.	How avalanche breakdown occurs in a semiconductor device under high reverse bias conditions and describe its effect on the device's performance?	2	K2	CO1
3.	Compare the working principles and characteristics of BJT and FET.	2	K2	CO2
4.	Define the Early Effect in a BJT and its impact on the transistor's behavior.	2	K1	CO2
5.	What are the differences between depletion mode and enhancement mode in MOSFETs?	2	K1	CO3
6.	Recall the the principle behind CMOS technology and how it is used in electronic circuits.	2	K1	CO3
7.	Identify various applications of solar cells in real world.	2	K2	CO4
8.	Recall the working principle of laser and their applications.	2	K1	CO4
9.	Plot the V-I characteristics of a tunnel diode based on its behavior under different biasing conditions.	2	K2	CO5
10.	State the advantages of a P-N-P-N diode in practical applications, such as in switching and voltage regulation circuits.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Explain the concept of effective mass and describe the derivation of the expression for the effective mass of an electron in a periodic potential field.	7	K2	CO1
		ii.	Describe the Fermi-Dirac distribution and explain its significance in determining the statistical behavior of electrons in solids.	6	K2	CO1
			(OR)			
	b)		Explain the V-I characteristics of a PN junction diode under both forward and reverse bias conditions, and describe how these characteristics affect its performance in various applications.	13	K2	CO1
12.	a)		Derive the expressions for voltage gain and current gain in a common base (CB) configuration using the hybrid model, and apply these expressions to calculate the performance of a transistor amplifier in a given circuit.	13	K3	CO2
			(OR)			
	b)		Implement different biasing techniques to a JFET under various operating conditions, and evaluate the device's performance in a practical circuit.	13	K3	CO2
13.	a)		Utilize the principles of construction and operation to analyze the characteristics of a depletion-type MOSFET, and use neat sketches to illustrate its behavior under different operating conditions.	13	K3	CO3
			(OR)			
	b)		Employ the working principle of CMOS technology to explain its functionality in electronic circuits, and demonstrate its use in various practical applications.	13	K3	CO3
14.	a)	i.	Leverage the V-I characteristics of a photodiode, and explain how these characteristics affect its performance in practical applications.	5	K2	CO4
		ii.	Illustrate the construction and operation of an LED to explain its behavior in various lighting and display applications.	8	K2	CO4
			(OR)			
	b)		Illustrate the principle of operation of a UJT and show that how these characteristics influence its behavior in practical electronic circuits.	13	K3	CO4
15.	a)		Explain the working principle of a Schottky diode with its V-I characteristics, and use this understanding to identify and discuss two practical applications.	13	K2	CO5

(OR)

	b)	Explain the V-I characteristics of a tunnel diode, and use this understanding to analyze its behavior under different biasing conditions.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	Design a circuit using a Zener diode to regulate voltage, and create a detailed explanation of its characteristics and applications in different scenarios.	9	K4	CO1
		ii.	Develop a model to explain the mechanisms of Avalanche and Zener breakdown, and create a comparison of how each mechanism impacts the operation of a Zener diode in various conditions.	6	K4	CO1
			(OR)			
	b)	i.	Given the following data for intrinsic Germanium (Ge) at 300 K, calculate the conductivity and resistivity of the sample:Intrinsic carrier concentration (ni) = 2.4×10^{19} m^{-3}, Electron mobility (μ_e) = 0.39 $m^2/V \cdot s$, Hole mobility (μ_p) = 0.19 $m^2/V \cdot s$ Find: a. Conductivity (σ) b. Resistivity (ρ)	5	K4	CO1
		ii.	Design a comprehensive report that explores the applications of LEDs, Solar Cells, PIN Diodes, and Photodetectors in medical, research and development, and information technology sectors. Create specific use cases, innovative solutions, and future trends for each technology within these fields.	10	K4	CO4