Reg. No										

AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (First Semester) Regular Examinations, February – 2025

24MVLPC11001 –Semiconductor Devices

ECE (VLSI Design)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. Write on zero-dimensional, one-dimensional, two-dimensional, and three-dimensional defects in a semiconductor? Provide examples.	CO1	K1
b. Difference between a lattice and a crystal in solid-state physics.	CO2	K2
c. Define the snapback breakdown mechanism in semiconductor devices.	CO3	K2
d. Write the meaning of a heterojunction in semiconductor physics.	CO4	K1
e. Write a short note on semiconductor wafers and doping techniques.	CO2	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. Recall the fundamental concept of a primitive cell in crystallography? Explain its role in defining crystal structures and unit cells.	5	CO1	K2
b. Differentiate between a lattice and a crystal in solid-state physics. Discuss their significance in semiconductor materials and device applications.	5	CO1	K3
(OR)			
c. Explain the IV characteristics of a PN junction diode. Describe its working principle, operating modes, and common applications.	5	CO1	K1
d. Compare forward bias and reverse bias in semiconductor devices. How do they influence charge carrier movement and diode operation?	5	CO1	K3
3.a. Describe the formation of a metal-semiconductor junction and classify its types based on their electrical characteristics. Provide examples of their applications.	5	CO2	K2
b. Differ P-type and N-type semiconductor junction. Discuss their charge carriers, doping mechanisms, and impact on electronic devices.	5	CO2	K4
(OR)			
c. Explain the structure and working principle of a High Electron Mobility Transistor (HEMT). Why is it widely used in high-frequency applications?	5	CO2	K4
d. Write on SPICE model, and how does it assist in semiconductor circuit simulation. Discuss its relevance in modern VLSI design.	5	CO2	K3
4.a. Compare the Ebers-Moll model and the Gummel-Poon model used in bipolar junction transistor (BJT) modeling. What are their differences and practical uses?	5	CO3	K2
b. Explain the Schottky barrier mechanism. How is it formed, what are its characteristics, and where is it commonly applied?	5	CO3	K3
(OR)			
c. Define base narrowing in semiconductor transistors. How does it affect device performance and efficiency?	5	CO3	K2

d.	What is the snapback breakdown mechanism in semiconductor devices? Under what conditions does it occur, and what impact does it have on reliability?	5	CO3	K3
5.a.	Describe the working principle of a MOS (Metal-Oxide-Semiconductor) capacitor. Explain its capacitance-voltage characteristics and its importance in IC design.	5	CO4	K4
b.	Analyze the IV curve characteristics of ohmic contacts in semiconductor devices. Why are they essential for ensuring reliable current conduction?	5	CO4	K3
	(OR)			
c.	Compare and contrast P-type and N-type semiconductor junctions, discussing their charge transport properties, doping processes, and practical applications.	5	CO4	K1
d.	Illustrate the structure of a HEMT (High Electron Mobility Transistor) and discuss why it is the preferred choice for high-speed and RF applications.	5	CO4	K2
6.a.	Classify the different types of metal-semiconductor junctions based on their electrical behavior. Provide real-world applications for each type.	5	CO2	K3
b.	Examine the snapback breakdown mechanism in semiconductor devices. What factors contribute to its occurrence, and what techniques can be used to mitigate its effects?	5	CO1	K3
	(OR)			
c.	Provide a detailed overview of the Gummel-Poon model. Discuss its mathematical formulation and how it is used in semiconductor device modeling.	5	CO1	K1
d.	Discuss the role of Schottky barriers in semiconductor devices. How do they enhance rectifiers, high-speed switching, and power applications?	5	CO3	K3

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