Reg. No										

AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (First Semester) Regular/Supplementary Examinations, January – 2026

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.	What is the working principle of a MOS capacitor?	CO1	K1
b.	What is the Schottky barrier mechanism, and how does it affect charge carrier movement?	CO2	K2
c.	What is a PN junction, and what are its key characteristics?	CO3	K2
d.	What are second-order effects in MOSFETs, and how do they impact device performance?	CO4	K1
e.	What are the current-voltage (CV) characteristics of a semiconductor device, and why are they important?	CO2	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	What is the snapback breakdown mechanism in semiconductor devices? What factors contribute to its occurrence, and how can it be mitigated?	5	CO1	K2
b.	Explain the significance of a primitive cell in crystallography. How does it help define unit cells and crystal structures?	5	CO1	K3
	(OR)			
c.	Describe the working principle and structure of a HEMT (High Electron Mobility Transistor). What makes it suitable for high-frequency applications?	5	CO1	K1
d.	What is base narrowing in a bipolar junction transistor (BJT), and how does it affect device performance?	5	CO1	K3
3.a.	Explain the Schottky barrier mechanism. How is it formed, and why is it preferred in high-speed switching applications?	5	CO2	K2
b.	Compare and contrast forward bias and reverse bias in semiconductor diodes. How do they influence charge carrier movement?	5	CO2	K4
	(OR)			
c.	Analyze the IV behavior of ohmic contacts in semiconductor devices. Why is a reliable ohmic contact essential for efficient current conduction?	5	CO2	K4
d.	What are metal-semiconductor junctions? How are they classified based on their electrical properties? Provide real-world applications.	5	CO2	K3
4.a.	What are the differences between a lattice and a crystal in semiconductor physics? Why are these concepts significant in material science?	5	CO3	K2
b.	Discuss the role of Schottky barriers in semiconductor devices. How do they enhance rectifiers, power electronics, and high-speed switching?	5	CO3	K3
	(OR)			
c.	Explain the importance of the SPICE model in circuit simulation. How does it assist in modern semiconductor and VLSI design?	5	CO3	K2
d.	Describe the IV characteristics of a PN junction diode. How does it operate under different modes, and where is it commonly used?	5	CO3	K3

5.a.	What is the function of the Gummel-Poon model in semiconductor device modeling? How does it differ from the Ebers-Moll model?	5	CO4	K4
b.	How does a semiconductor's crystal structure influence its electrical properties? Explain the relationship between unit cells and primitive cells.	5	CO4	K3
	(OR)			
c.	What is the impact of metal-semiconductor junctions on device performance? How do their electrical characteristics determine their applications?	5	CO4	K1
d.	What makes High Electron Mobility Transistors (HEMTs) unique? How do they compare to conventional field-effect transistors?	5	CO4	K2
6.a.	Compare P-type and N-type semiconductor junctions, focusing on charge carriers, doping mechanisms, and their impact on electronic devices.	5	CO2	K3
b.	How does the snapback breakdown mechanism affect semiconductor reliability? What techniques are used to prevent its occurrence?	5	CO1	K3
	(OR)			
c.	What are the key differences between the Ebers-Moll model and the Gummel-Poon model in BJT analysis? Where are these models applied?	5	CO1	K1
d.	Explain how metal-oxide-semiconductor (MOS) capacitors work. How do their capacitance-voltage characteristics affect IC design?	5	CO3	K3

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