QP Code: R264A022 | Reg. No | | | | | | | | | | | AY 23

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Fourth Semester – Regular/Supplementary) Examinations, April 2026

23BECPC24003 - Electronic Devices
(ECE / EE(VLSI))

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. Define Boltzmann's Approximation.	CO1	K1
b. Distinguish between PN junction diode and schottky diode.	CO3	K1
c. In a bipolar transistor biased in the forward active region the base current is 6 µA and collector current is 500 µA. Determine α.	CO4	K2
d. Find out the probability of a state being empty for the energy state 3KT above the Fermi-level.	CO1	K2
e. Define 'Threshold voltage' for a MOS capacitor.	CO5	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. Derive the expression for the thermal equilibrium concentration of electrons in the conduction band using effective density of states, Fermi energy and other terms.	5	CO1	K1
b. Calculate the thermal equilibrium hole concentration in Si at T = 450 K. The Fermi energy is 0.32 eV below the conduction band energy.	5	CO1	K3
(OR)			
c. Explain how the position of Fermi Energy varies with respect to doping concentration and temperature along with the plot.	5	CO1	K1
d. The electron concentration in silicon at T=300K is $n_0=5x10^5cm^{-3}$ i. Determine p_0. Is this n-type or P-Type material ii. Determine the position of Fermi energy with respect to intrinsic Fermi energy level	5	CO1	K3
3.a. Derive the expression for the potential across the junction of a PN Junction in Zero bias.	5	CO3	K1
b. Calculate the Built-in potential barrier and Space Charge Width for Silicon PN junction, where $N_a= 4 \times10^{16}$ cm^{-3} and $N_d= 5 \times10^{15}$ cm^{-3} at T = 300 K.	5	CO3	K3
(OR)			
c. Derive the Einstein relation in semiconductor.	5	CO2	K1
d. Explain how mobility affected by Lattice Scattering and Ionised impurity Scattering.	5	CO2	K1
4.a. Explain Early Effect in a transistor with the help of suitable diagram.	5	CO3	K2
b. Derive and explain Ebers-Moll model.	5	CO3	K2
(OR)			

c.	Explain Punch through break down.	5	CO3	K1
d.	Derive the total current density in a semiconductor, including the expression of diffusion and drift current density.	5	CO2	K2
5.a.	Explain CMOS Fabrication Technology with suitable diagram of a CMOS Inverter.	5	CO4	K2
b.	What is an Ohmic contact? Discuss about types of Ohmic contact.	5	CO4	K1
	(OR)			
c.	Write a brief note on Schottky diode operation with suitable energy band diagram.	5	CO4	K1
d.	Write down the difference between Schottky diode and PN Junction.	5	CO4	K1
6.a.	Write a short note on Photodiode.	5	CO6	K1
b.	Explain MOS C-V Characteristics of a N-Mos with suitable Diagram.	5	CO5	K2
	(OR)			
c.	Write a short note on HEMT	5	CO5	K1
d.	Calculate C_{ox}, C'_{min} and C'_{FB} of a MOS capacitor with a p type silicon substrate at T=300K Doped with Na = $10^{16}cm^{-3}$. The oxide is SiO_2 with a thickness of $550A^o$ and the gate is Aluminium.	5	CO5	K3

--- End of Paper ---