QP Code: RA23BTECH129 | Reg. No | | | | | | | | | | | AR 22

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

B. Tech (Fourth Semester - Regular) Examinations, April – 2025

23BECPC24003 – Electronic Devices

(Electronics and Communication Engineering)

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 Boltzmann's Approximation?	CO1	K2
b. Why the width of the Base of a BJT is made smaller than the minority carrier diffusion length?	CO3	K2
c. Define 'Flat-Band voltage' for a MOS capacitor.	CO4	K1
d. In a bipolar transistor biased in the forward active region the base current is 6 μA and collector current is 500 μA. Determine α.	CO2	K2
e. Write the Shockley's boundary condition for a forward bias PN Junction	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.	6	CO1	K3
b. Calculate the thermal equilibrium electron concentration in Si at T = 400 K. The Fermi energy is 0.34 eV above the valence band energy.	4	CO1	K4
(OR)			
c. 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	4	CO1	K4
d. Derive the expression for variation of Fermi Energy with respect to doping concentration and temperature along with the plot.	6	CO1	K3
3.a. Derive Total current density in a semiconductor including the expression of diffusion and drift current density.	10	CO2	K3
(OR)			
b. Derive the expression for Potential Across the junction of a PN Junction in Zero bias. Also derive the expression of V_{bi} in terms of x_n and x_p.	10	CO2	K3
4.a. Derive an expression for capacitance of a reverse biased PN junction?	6	CO3	K3
b. Write down the difference between Schottky diode and PN Junction	4	CO3	K1
(OR)			
c. Explain punch through breakdown in a transistor with the help of suitable diagram.	6	CO3	K2
d. What is Eber's Moll Model? Derive the expression for I_c & I_B.	4	CO3	K3

5.a.	Explain CMOS Fabrication Technology with suitable diagram of a CMOS Inverter.	10	CO4	K1
	(OR)			
b.	Explain MOS C-V Characteristics of a N-Mos with suitable diagram.	10	CO4	K2
6.a.	Explain Base-width Modulation in a transistor with the help of suitable diagram.	5	CO5	K2
b.	Derive the expression of space charge width of a P-N Junction.	5	CO5	K3
	(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	K4

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