GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Fourth Semester - Regular) Examinations, May – 2024

21BECPC24003 – Semiconductor Devices

(ECE)

Time: 3 hrs Maximum: 70 Marks

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

		CO #	Blooms Level
Q.1.	Answer ***ALL*** questions		
a.	Why the width of the Base of a BJT is made smaller than the minority carrier diffusion length?	CO3	K2
b.	Define 'Flat-Band voltage' for a MOS capacitor.	CO4	K2
c.	Find out the probability of a state being empty for the energy state 0.22eV above the Fermi-level.	CO1	K3
d.	Distinguish between PN junction diode and schottky diode	CO2	K1
e.	In a bipolar transistor biased in the forward active region the base current is 6 μA and collector current is 500 μA. Determine α.	CO3	K3

PART – B **(15 x 4 = 60 Marks)**

		Marks	CO #	Blooms Level
	Answer ***ALL*** the questions			
2. a.	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	K2
b.	Derive the expression for the thermal equilibrium concentration of electrons in the conduction band using effective density of states, Fermi energy and other terms.	10	CO1	K3
	(OR)			
c.	The electron concentration in silicon at T=300K is $n_0=5x10^5cm^{-3}$	5	CO1	K2
	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			
d.	Derive the expression for variation of Fermi Energy with respect to doping concentration and temperature along with the plot.	10	CO1	K3
3.a.	Derive the Einstein relation linking 'mobility' & 'diffusion co-efficient.	10	CO2	K3
b.	Derive the expression for Electric field of a PN Junction in Zero bias.	5	CO2	K3
	(OR)			
c.	Derive Total current density in a semiconductor including the expression of diffusion and drift current density.	10	CO2	K3
d.	Derive an expression for capacitance of a reverse biased PN junction?	5	CO2	K3
4.a.	Explain punch through breakdown in a transistor with the help of suitable diagram.	7	CO3	K1
b.	What is Eber's Moll Model? Derive the expression for Ic & IB.	8	CO3	K3
	(OR)			
c.	What is an Ohmic contact? Discuss about types of Ohmic contact.	10	CO3	K1
d.	Write a brief note on Schottky diode operation with suitable energy band diagram	5	CO3	K1

5.a.	Explain CMOS Fabrication Technology with suitable diagram.	10	CO4	K2
b.	Write a short note on HEMT.	5	CO4	K1
	(OR)			
c.	Explain MOS C-V Characteristics of a N-Mos with suitable diagram	10	CO4	K1
d.	Calculate Cox, C'min and C'FB of a MOS capacitor with a p type silicon substrate at T=300K Doped with Na = 1016cm-3. The oxide is sio2 with a thickness of 350Ao and the gate is Aluminium.	5	CO4	K3

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