

b)	Derive the expression for diffusion current density of a non-uniformly doped P-type semiconductor.	4	2	1	2
12. a)	Derive the expression for transition capacitance of a P ⁺ -N junction and draw PN diode high frequency model.	5	4	1	2
b)	Explain the temperature dependence of V-I characteristics of a PN diode.	3		1	1
			1		
13. a)	Describe the V-I characteristics of a Tunnel diode and list any two applications.	4		1	1
			1		
b)	Design a Zener regulator circuit to produce a regulated voltage of 8V for a load current varies from 1mA to 20mA and if input varies between 12V to 18V. Assume $I_{knee}=0.1mA$ and $I_{zmax}=50mA$.	4	4	3	3
14. a)	Explain the operation of N-channel EMOSFET with the help of its drain and transfer characteristics. Also draw its small-signal model.	5	2	5	2
b)	A BJT has $\alpha=0.99$, $I_B=25 \mu A$ and $I_{CBO}=200nA$. Calculate collector current and emitter current and also calculate percentage error in emitter current when leakage current is neglected.	3	4	5	2
15. a)	Analyze the BJT CE amplifier with $R_S = 2.2k\Omega$ and $R_L = 5k\Omega$ for its current gain A_i , input impedance R_i , voltage gain A_v , and output impedance R_o using h-parameter model. The CE h-parameters are $h_{ie} = 1.1k\Omega$, $h_{re} = 0.4 \times 10^{-4}$, $h_{fe} = 150$ and $h_{oe} = 25 \mu A/V$.	4	4	5	2
b)	Explain the fabrication process of an Integrated circuit.	4	2	6	1
16. a)	What is Graded impurity distribution in a semiconductor and derive the relation between impurity concentration and the electric field.	4	2	2	2
b)	Calculate depletion-region width of a silicon junction and electric field at junction with $N_A = 1.2 \times 10^{15}/cm^3$, $N_D = 1.5 \times 10^{15}/cm^3$, $A=0.001cm^2$, reverse bias = -2V, $\epsilon=1.04 \times 10^{-12}F/cm$ and $n_i=1.5 \times 10^{10}/cm^3$.	4	3	1	2
17.	Answer any <i>two</i> of the following:				
a)	List the applications of LED and Photo diodes and draw their equivalent circuits.	4	3	1	1
b)	Explain the operation of a CMOS inverter with the help of its operation.	4	2	6	2
c)	Design a self-bias circuit to set the operating point at Q(4V,1.5mA) and the stability factor is ≤ 6 .	4	4	5	3

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	23.75%
ii)	Blooms Taxonomy Level – 2	36.25%
iii)	Blooms Taxonomy Level – 3 & 4	40%

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