GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2022

ELECTRONIC DEVICES

EC303

TIME ALLOTTED: 3Hours **FULL MARKS:70**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

(Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

		Marks	CO No
1. i)	Depletion region of p-n junction diode consisting of a) free electrons b) free holes c) immobile acceptors and donor ions d) photon	1	CO2
ii)	When photodiode operates as a detector diode, operating region of V-I characteristics is a) 1^{st} quadrant b) 2^{nd} quadrant c) 3^{rd} quadrant d) 4^{th} quadrant	1	CO6
iii)	For n-type degenerate semiconductor position of Fermi level is a) Inside conduction band b) Inside valance band c) Middle of forbidden gap d) None	1	CO1
iv)	The threshold voltage of N channel Enhancement type MOSFET is a) Positive b) Negative c) Zero d) Infinity	1	CO4
v)	Ideal OP-AMP has input and output impedances (R_{in} and R_{out}) as a) $R_{in} = 0$, $R_{out} = \infty$ b) $R_{in} = \infty$, $R_{out} = 0$ c) $R_{in} = 1\Omega$, $R_{out} = 0$ d) $R_{in} = 0$, $R_{out} = 1\Omega$	1	CO5

vi) For Zener breakdown the condition is — 1 — CO2
a) P-N junction is lightly doped
b) P-N junction is heavily doped
c) P-N junction is moderately doped
d) P region is heavily doped but N region is lightly doped

vii) Which one is true for BJT ? — 1 — CO3
a) collector region is heavily doped
b) emitter region is lightly doped
c) base region has least doping
d) base region is widest

viii) At higher temperature in heavily doped semiconductor, the mobility is — 1 — CO1
a) increased
b) decreased
c) saturated
d) linearly increasing

ix) The amplification factor of JFET is — 1 — CO4
a) $\mu = r_d \times g_m$
b) $r_d = \mu \times g_m$
c) $g_m = r_d \times \mu$
d) $\mu = 1 \times g_m$

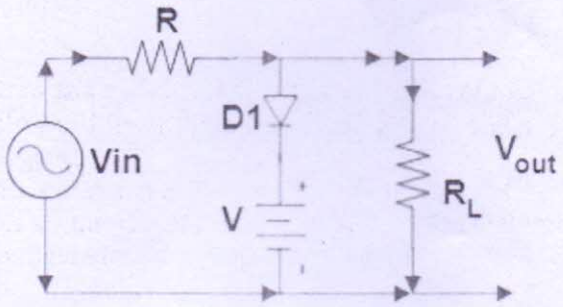
x) Oscillation occurs in an amplifier with the gain (A) and feedback factor (β) if — 1 — CO5
a) $|A\beta| > 1, phase\ angle\ of A\beta = 2\pi$
b) $|A\beta| = 1, phase\ angle\ of A\beta = 2\pi$
c) $|A\beta| < 1, phase\ angle\ of A\beta > 2\pi$
d) $|A\beta| \ll 1, phase\ angle\ of A\beta \ll 2\pi$

xi) MOSFET operates as an amplifier in — 1 — CO4
a) Active region
b) Saturation region
c) Ohmic region
d) Cut-off region

GROUP – B
(Short Answer Type Questions)
(Answer any *three* of the following) **3 x 5 = 15**

		Marks	CO No
2.	With E-k diagram explain direct and indirect band-gap semiconductor. State Mass action law for a semiconductor.	5	CO1
3. a.	Describe the working principle of NPN transistor.	3	CO3
b.	The transistor has I_E = 10 mA and α = 0.98. Find the value of base and collector currents	2	CO3

4.	Explain the working principle of Enhancement type N channel MOSFET.	5	CO3
5. a.	What are the drift and diffusion phenomena of a semiconductor?	3	CO1
b.	Draw the output waveform of the following circuit:	2	CO2



The maximum value of V_{in}= V_m

6.	Explain the operation of OP-AMP based differentiator circuit.	5	CO5

GROUP – C
(Long Answer Type Questions)

(Answer any *three* of the following) **3 x 15 = 45**

		Marks	CO No
7. a.	Draw and explain the C-V characteristics of MOS capacitor under low frequency.	5	CO4
b.	Discuss different feedback topologies of negative feedback amplifier with block diagram.	5	CO5
c.	Prove that for BJT $I_C = \beta I_B + (1+\beta) I_{CO}$ .The terms have their usual meaning. Draw the output characteristics of NPN transistor in common emitter configuration with proper labeling.	5	CO3
8. a.	Describe the drain and transfer characteristics of N-channel JFET. In an N-channel JFET: I_{DSS}= 10mA, $V_{pinchoff}$=5V, calculate the I_{DS} for V_{GS}=-2.5 V.	9	CO3
b.	Calculate CMRR of an OP-AMP in dB if differential voltage gain and common mode voltage gain are 10^6 and 0.001 respectively. What is virtual ground? Discuss the operation of OP-AMP based Non-inverting amplifier.	6	CO5
9. a.	Derive the expression of energy gap of an intrinsic semiconductor. Determine the position of Fermi Energy level if the effective mass of electron and hole are as follows: $m_n^* = 0.5m_p^*$	7	CO1
b.	Describe the working principle of P-N Junction Solar Cell.	8	CO6

10 a.	Describe diode's behavior under forward and reverse biased condition with energy band diagram and draw its I-V characteristics with proper labeling.	7	CO2
b.	Write down the ideal characteristics of OP-AMP.	2	
c.	Explain the working principle of Bridge Rectifier. What is ripple factor? Write down the expression of ripple factor for bridge rectifier.	6	CO2
11.	Write Short note: (Any three)	3x5=15	
a.	FET parameters	5	CO3
b.	OP-AMP Adder Circuit	5	CO5
c.	Zener and Avalanche breakdown	5	CO2
d.	Clamper	5	CO2
e.	Ebers Mol model	5	CO3