VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (E.C.E.) III-Semester Supplementary Examinations, August-2022

Electronic Devices

Time: 3 hours

Max. Marks: 60

Note: Answer all questions from Part-A and any FIVE from Part-B

Part-A $(10 \times 2 = 20 \text{ Marks})$

Q. No.	Stem of the question	M	L	CO	PO
1.	Differentiate between lattice scattering and ionization scattering mechanisms in a semiconductor.	2	1	1	1
2.	The hole density in silicon is given by $p(x) = 10^{18} e^{-(x/L_p)}$ ($x \ge 0$) where	2	2	2	2
	$L_p=2\times 10^{-4}$ cm. Assume the hole diffusion coefficient is $D_p=12$ cm ² /s. Determine the hole diffusion current density at $x=0$ and $x=2.2\times 10^{-4}$ cm.				
3.	A germanium diode has a reverse saturation current of 15 μ A. Calculate the forward bias voltage at the room temperature of 27°C and 2% of the rated current is flowing through the forward biased diode. The diode forward rated current is 2 A.	2	2	1	2
4.	Determine V ₀ and I ₀ for the network of figure shown below.	2	4	1	2
	912V				
	Si Z Ge				
	≥22ka				
	¥±0				
5.	Distinguish Schottky diode and normal PN diode.	2	1	2	1
6.	Determine the ripple factor and PIV of the diodes in a Bridge rectifier with capacitor filter if the input of 5:1 transformer is 230V rms, 50 Hz supply and $50\mu F$ capacitor is connected across $2K\Omega$ load.	2	4	3	2
7.	Draw the C-V characteristics of a MOS capacitor and also indicate its different regions.	2	1	4	1
8.	A JFET has a driven current I_D of 4mA. If I_{DSS} =8mA and $V_{GS(off)}$ =-6V.Find the value of V_{GS} .	2	1	4	1
9.	Define thermal runaway and which biasing circuit of BJT is used to obtain the stable operating point.	2	1	5	1
10.	Define oxidation and photolithography process in an IC fabrication.	2	1	6	1
	Part-B $(5 \times 8 = 40 \text{ Marks})$				
11. a	Define drift velocity and discuss about velocity saturation in a semiconductor.	4	2	1	1

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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 α =0.99, I _B =25 μ 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 $h_{ie}=1.1k\Omega$, $h_{re}=0.4x10^{-4}$, $h_{fe}=150$ 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	11	2
17.	Answer any two 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%

