PVP 22

Code: 22ECMC1T4

I M.Tech - I Semester – Regular Examinations - MARCH - 2023

MICROWAVE SOLID STATE DEVICES
(MICROWAVE & COMMUNICATION ENGINEERING)

Duration: 3 hours Max. Marks: 60

Note: 1. This paper contains 4 questions from 4 units of Syllabus. Each unit carries 15 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
		UNIT-I			
1	a)	Explain the amplification phenomena of common emitter n-p-n transistor.	L2	CO1	8 M
	b)	An *n-Ge-p*-GaAs-n-GaAs heterojunction transistor at 300° K has the following parameters: Donor density in *n* -Ge region: N_d= $5\times10^{18}\ cm^{-3}$, Acceptor density in *p* -GaAs region: N_a= $6\times10^{16}\ cm^{-3}$, Hole lifetime: $\tau_p = 6\mu s$, Bias voltage at emitter junction: V_E= 1V, Cross section: A=$2 \times 10^{-2} cm^2$. Hole mobility μ_p=400 cm^2/v-s Calculate: i) The built-in voltage in the p-GaAs side ii) The hole diffusion constant iii) The minority hole density in the *n* -Ge region	L2	CO1	7 M

		iv) The minority electron density in the p-GaAs region v) The hole diffusion length vi) The emitter-junction current			
OR					
2	a)	Explain the principle of operation and characteristics of microwave tunnel diode.	L2	CO1	8 M
	b)	Discuss the power frequency limitations of silicon bipolar transistor.	L2	CO1	7 M
UNIT-II					
3	a)	Sketch the cross section of HEMT and discuss the processing steps for HEMT device coupled FET logic circuits.	L3	CO2	8 M
	b)	Interpret the structure and operation of MESFET.	L3	CO2	7 M
OR					
4	a)	Why GaAs MESFETs are preferred over Si MESFETs?	L2	CO2	7 M
	b)	A certain GaAs MESFET has the following parameters: Channel height: a=0.1μm, Electron concentration: N_d= $8\times10^{17}\ cm^{-3}$, Relative dielectric constant: ε_r=13.10. Calculate the pinch-off voltage.	L3	CO2	8 M
UNIT-III					
5	a)	Interpret the modes of operation for Gunn diode.	L3	CO3	8 M

	b)	A n-Type GaAs Gunn Diode has the following parameters, Electron density: $n = 10^{18}\ cm^{-3}$, Electron density at lower valley: $n_l = 10^{10}\ cm^{-3}$, Electron density at upper valley: $n_u = 10^{8}\ cm^{-3}$, Temperature: T = 300°K, μ_l=8000 cm^2/v-sec, μ_u=180 cm^2/v-sec. Calculate the conductivity of the diode.	L3	CO3	7 M
OR					
6	a)	Outline the features of LSA diodes and InP diodes.	L2	CO3	8 M
	b)	Demonstrate the Ridley-Watkins—Hilsum theory.	L3	CO3	7 M
UNIT-IV					
7	a)	Analyze the principle of operation of TRAPATT diode with neat diagram.	L4	CO4	8 M
	b)	An IMPATT diode has the following parameters: Carrier drift velocity: v_d = 2 x 10^7 cm/s, Drift-region length: L = 6 μm, Maximum operating voltage: V_{omax} = 100 V, Maximum operating current: I_{omax} = 200 mA, Efficiency: η=15 %, Breakdown voltage: V_{bd} = 90 V, Compute: (i) The maximum CW output power in watts; (ii) The resonant frequency in gigahertz.	L3	CO4	7 M
OR					
8	a)	What does IMPATT diode stands for and derive power, efficiency of the same?	L3	CO4	8 M

	b)	Describe the advantages and disadvantages of the parametric devices.	L2	CO4	7 M