cCode No: R1921023 **R19** SET - 1

II B. Tech I Semester Regular Examinations, March - 2021
ELECTRONIC DEVICES AND CIRCUITS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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1	a)	Explain Hall effect. Derive expression of Hall voltage and state its applications.	[9M]
	b)	If the energy band gap is 1.1 eV and electron mobility in silicon is 0.13 m^2 / volt-sec, hole mobility is is 0.05 m^2 / volt-sec and N=3 x $10^{25}/m^3$ at 300K. Find the intrinsic carrier concentration and conductivity of silicon.	[6M]
		Or	
2	a)	Explain about V-I characteristics of PN junction diode in forward bias & reverse bias conditions.	[8M]
	b)	Draw and explain the energy band diagram of PN junction diode.	[7M]
3	a)	List the salient features of Tunnel diode.	[3M]
	b)	Explain the V-I characteristics of Photodiode.	[6M]
	c)	Explain the construction and operation of LED.	[6M]
		Or	
4	a)	Define ripple factor and derive an expression for ripple factor in a full-wave rectifier.	[7M]
	b)	Give the comparison of various filter circuits in terms of ripple factors.	[5M]
	c)	What are the advantages of a full-wave bridge rectifier as compared to a full-wave centre-tapped rectifier?	[3M]
5	a)	Draw and explain the input and output characteristics of BJT in common base configuration.	[9M]
	b)	Calculate the α_{dc} and β_{dc} for the given transistor for which I_C=5mA, I_B=50μA and I_{CO} = 1μA.	[6M]
		Or	
6	a)	Explain how a FET is used as a voltage variable resistor.	[5M]
	b)	Define the following terms of a FET: (i) I_{DSS} (ii) Tran conductance (iii) Pinch-off voltage (iv) Amplification factor	[8M]
	c)	List the applications of FET.	[2M]
7	a)	Define stability factor. Explain the need of biasing.	[6M]
	b)	A silicon transistor with β=80 is used in self biasing arrangement with V_{CC} = 15V, R_C = 4.7KΩ. The operating point Q is at V_{CE} = 8.2V, I_C = 1.2mA. Find the values of R_1 and R_2.	[6M]
	c)	What is the condition for thermal stability in CE configuration?	[3M]
		Or	
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8 a) Explain diode compensation against variation in base-emitter voltage V_{BE}. [6M]

b) Draw a fixed bias circuit and derive an expression for the stability factor. [6M]

c) Write a brief note on Thermal runaway. [3M]

9 Derive the expressions for voltage gain, current gain, input impedance and output impedance of CE amplifier using exact and approximate analysis. [15M]

Or

10 a) Determine the current gain, input impedance and voltage gain when the transistor is connected in CB configuration with a load R_L=10KΩ, V_{CB}=10V, I_C=1mA, h_{ib}=20Ω, h_{rb}=5x10^{-4}, h_{fb}=-0.98, h_{ob}=10^{-7} ℧. [6M]

b) From the low frequency small signal FET model, derive the FET parameters. [9M]

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1	a)	Briefly explain about Fermi Dirac function and Fermi level in intrinsic and extrinsic semiconductors.	[9M]
	b)	Find the conductivity of silicon atom when the donor impurities of 1 in 10^8 is applied. The intrinsic value of silicon atom is 1.5 x 10^{10} cm^{-3} at 300^0K. The mobility of the electrons and holes are 1300 cm^2 /V-s and 500 cm^2 /V-s respectively. The number of silicon atoms is 5 x 10^{25} cm^{-3}.	[6M]
		Or	
2	a)	State and explain Mass Action law.	[6M]
	b)	The current flow through a PN-junction diode is 0.75 mA at forward-biased voltage 350 mV and 20 mA at forward-biased voltage 500 mV. Determine the value of η if the junction operates at 295K.	[6M]
	c)	List the applications of PN-junction diode.	[3M]
3	a)	Explain in detail about principle of operation and characteristics of Tunnel diode.	[10M]
	b)	List the salient features and applications of LED.	[5M]
		Or	
4	a)	A centre-tapped single-phase full-wave rectifier has two diodes and the forward resistance of each diode is 25 ohms. The transformer secondary voltage from centre to each half of the secondary winding is 30 $\sqrt{2}$ sin ωt and the load resistance is 2000 ohms. Determine (i) the average value of load current, and (ii) the peak inverse voltage of each diode.	[6M]
	b)	Sketch the circuit of a bridge rectifier and explain its operation	[7M]
	c)	Why are filters used in a dc power supply?	[2M]
5	a)	Explain the various current components in a transistor.	[6M]
	b)	Give the comparison between CB, CE and CC configurations of BJT.	[5M]
	c)	Write a brief note on Photo transistor.	[4M]
		Or	
6	a)	Explain the drain characteristics of JFET.	[5M]
	b)	Derive the relationship between trans conductance, drain resistance and amplification factor.	[4M]
	c)	An N-channel FET has the following parameters: I_{DSS} = 12mA, V_P = -8V and g_{mo} = 4000 μs Determine the drain current and trans conductance at V_{GS} = -5V	[6M]
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7	a)	Explain about Thermal stability.	[5M]
	b)	Design a collector to base bias circuit for the given specifications: V_{CC} = 15V, V_{CE} = 5V, I_{CE} = 5mA and β=100.	[8M]
	c)	What are the factors affecting the Q-point?	[2M]

Or

8	a)	Define Q-point.	[2M]
	b)	Give the comparison between fixed bias, collector to base bias and self-bias circuits.	[6M]
	c)	Draw a circuit which uses a diode to compensate for changes in I_{CO}. Explain how stabilization is achieved in the circuit	[7M]
9	a)	Obtain CB parameters in terms of CE parameters.	[12M]
	b)	Define the various h-parameters and give their units.	[3M]

Or

10	a)	Draw the h-parameter equivalent circuit for a typical common base amplifier and derive expressions for A_i and A_v.	[8M]
	b)	Draw the small signal model of an FET and explain the significance of each element.	[7M]

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1	a)	Explain energy band diagram of insulator, semiconductor and conductor.	[9M]
	b)	At room temperature of 300K, the Fermi level is 0.35 eV above the valence bond in a P-type semiconductor. When the temperature is increased to (i) 350K, and (ii) 400K, calculate the position of Fermi level.	[6M]
		Or	
2	a)	Discuss in brief about the current components in PN junction diode.	[7M]
	b)	Explain the volt-ampere characteristics of PN junction diode.	[8M]
3	a)	Explain the breakdown mechanisms in semiconductor diodes.	[8M]
	b)	Briefly explain about the different operating regions of SCR.	[7M]
		Or	
4	a)	Draw the circuit diagram of a full-wave rectifier using center-tap transformer. Explain its working principle.	[7M]
	b)	A sinusoidal voltage whose V_m = 24V is applied to a half-wave rectifier. The diode may be considered to be ideal and R_L = 1.8 KΩ is connected as load. Determine the following: (i) Peak value of current (ii) RMS value of current (iii) DC value of current (iv) Ripple factor	[8M]
5	a)	Draw and explain the input and output characteristics of BJT in common emitter configuration.	[9M]
	b)	Explain about Ebers-Moll model of a transistor.	[6M]
		Or	
6	a)	With the help of neat sketches explain the operation of JFET.	[8M]
	b)	What is the importance of SiO_2 layer in MOSFET?	[3M]
	c)	What is MOSFET? What are the different types of MOSFETs?	[4M]
7	a)	Explain the importance of biasing.	[4M]
	b)	Briefly explain about stabilization against variations in V_{BE} and β for the self-bias circuit.	[7M]
	c)	Write a brief note on Stability factors.	[4M]
		Or	
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8	a)	Derive an expression for the condition to avoid thermal runaway.	[6M]
	b)	What are the disadvantages of fixed bias?	[2M]
	c)	Design a voltage divider bias circuit for specified condition V_{CC} = 12V, V_{CE} = 6V, I_C = 1 mA, S = 20, β = 100 and V_E = 1V.	[7M]
9	a)	Explain the small signal operation of CG amplifier and also derive an expression for its performance measure.	[8M]
	b)	Explain how to calculate CE h-parameters from the input and output characteristics.	[7M]

Or

10	a)	A CE amplifier is drawn by a voltage source of internal resistance r_s = 800 Ω, and the load impedance is a resistance R_L = 1000Ω. The h-parameters are h_{ie}=1KΩ, h_{re}=2x10^{-4}, h_{fe}=50 and h_{oe}=25μA/V. Compute the current gain, input resistance, voltage gain and output resistance.	[10M]
	b)	Name the three small signal models used for a BJT. Which of the three models of a BJT provide accurate analysis and why?	[5M]

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1	a)	Write notes on the following terms: (i) electron (ii) hole (iii) conductivity (iv) mobility	[8M]
	b)	Derive an expression for continuity equation and explain its importance.	[7M]
		Or	
2	a)	The current flow through a PN-junction germanium diode is 50 mA for a forward biased voltage of 0.5V at 300K. Calculate the static and dynamic resistances of the diode.	[4M]
	b)	Discuss in brief about the effect of temperature on V-I characteristics of a diode.	[7M]
	c)	Differentiate between transition and diffusion capacitances.	[4M]
3	a)	Explain how a zener diode acts as a voltage regulator.	[4M]
	b)	Write a brief note on Zener breakdown mechanism in a zener diode.	[5M]
	c)	Draw and explain the V-I characteristics of the UJT.	[6M]
		Or	
4	a)	Draw the circuit diagram of half-wave rectifier. Explain its working principle. Determine the following parameters: (i) dc output voltage (ii) rms output voltage	[10M]
	b)	Determine the ripple factors of an L-section filter and Capacitive filter with C=50μF, V_{dc}=12v, R_L=10 K Ω, f=50Hz and L=10H used with FWR.	[5M]
5	a)	Explain about transistor as an amplifier.	[7M]
	b)	Define α, β and γ of a transistor. Show how they are related to each other.	[8M]
		Or	
6	a)	Give the comparison between JFET and MOSFET.	[4M]
	b)	Explain the principle of operation of enhancement MOSFET.	[6M]
	c)	Explain the transfer characteristics of JFET.	[5M]
7	a)	Derive an expression for the stability factor of a self bias circuit.	[6M]
	b)	Explain the operation of collector to base bias.	[7M]
	c)	Define stability factor ‘S’.	[2M]
		Or	
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8 a) Explain how thermistor is used for bias compensation. [7M]

b) Explain about stabilization against variations in V_{BE}, I_C and β. [8M]

9 a) Draw and explain the h-parameter model of a BJT for CC configuration. [7M]

b) Explain the determination of h-parameters from transistor characteristics. [8M]

Or

10 a) The h-parameters of a transistor used in CE amplifier are given as: h_{ie}=1KΩ, h_{re}=2x10^{-4}, h_{fe}=100 and h_{oe}=20μA/V. If R_c = 5KΩ and R_s = 1KΩ, determine A_I, A_V, R_I and R_O. [10M]

b) Give the comparison of FET amplifiers. [5M]