Code No: R2021041 **R20** SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, December-2023
ELECTRONIC DEVICES AND CIRCUITS
(Com to ECE, EIE, ECT)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1	a)	Differentiate diffusion current and drift current.	[7M]
	b)	A Ge diode has a saturation current of 10μA at 300° K. Determine the saturation current at 400°K.	[7M]

OR

2	a)	Define the following: i. forward static and dynamic resistances of diode. ii. diffusion capacitance iii. transition capacitance.	[8M]
	b)	Show the position of Fermi level in N type and P type semiconductors.	[6M]

UNIT-II

3	a)	Explain the construction and operation of UJT.	[7M]
	b)	Explain how zener diode is used as a voltage regulator.	[7M]

OR

4	a)	A 230V, 60Hz voltage is applied to the primary of a 5:1 step down, center tapped transformer used in a full wave rectifier having a load of 900Ω. If the diode resistance and the secondary coil resistance together has a resistance of 100Ω, determine i) dc voltage across the load ii) dc current flowing through the load iii) dc power delivered to the load iv) PIV across each diode	[10M]
	b)	Give the advantages of LED.	[4M]

UNIT-III

5	a)	Describe early effect with relevant expressions and diagram.	[7M]
	b)	Mention the advantages and applications of JFET.	[7M]

OR

6	a)	With neat sketches and necessary waveforms, explain the input and output characteristics of a BJT in CE configuration. Also derive expression for output current.	[9M]
	b)	Identify and formulate the differences between BJT and FET.	[5M]
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UNIT-IV

7 a) Explain how self biasing can be done in a BJT with relevant sketches and waveforms. [7M]

b) Design a self bias circuit using silicon transistor to achieve a stability factor of 10, with the following specifications: V_{CC} = 16V, V_{BE} = 0.7V, V_{CEQ} = 8V, I_{CQ} = 4 mA & β = 50. [7M]

OR

8 a) Justify statement "Potential divider bias is the most commonly used biasing method" for BJT circuits. Explain how bias compensation can be done in such biasing through diodes. [7M]

b) Explain how I_{CO} variations are compensated with the help of diode and thermistor in transistor biasing circuits? [7M]

UNIT-V

9 a) Define all the four hybrid parameters of a BJT in CE configuration. Draw the circuit and its equivalent circuit. [6M]

b) A CE amplifier is driven by a voltage source of internal resistance Rs = 800Ω and the load impedance of R_L=1000Ω. The h-parameters are h_{ie}=1k, h_{fe}=50, hoe = 25μA/V and hre = 2 x 10^{-4}. Calculate current gain, voltage gain, input impedance and output impedance using exact analysis and approximate analysis. [8M]

OR

10 a) What is Two port network? [4M]

b) Derive input impedance, output impedance and voltage gain of JFET Common Drain amplifier with neat diagram. [10M]

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UNIT-I

1	a)	Draw the energy band diagram of a semiconductor. Explain.	[7M]
	b)	Analyze the V-I characteristics of PN diode.	[7M]

OR

2	a)	Define the following: i. forward and reverse recovery time of a diode. ii. knee voltage and breakdown voltage	[6M]
	b)	State and derive the mathematical equation which relates voltage applied across the PN junction diode and current flowing through it and list the PN diode parameters.	[8M]

UNIT-II

3	a)	Draw the circuit of full-wave rectifier with capacitor filter. Explain its operation with necessary equations.	[7M]
	b)	Over what range of input voltage will the Zener in a voltage regulator in circuit maintain 30V across 2000 Ω load ,assuming that series resistance R = 200Ω and zener current rating is 25mA.	[7M]

OR

4	a)	Explain the V-I characteristics and application of SCR and explain its two transistor model.	[8M]
	b)	Compare HWR with FWR.	[6M]

UNIT-III

5	a)	Derive an expression for pinch off voltage in FET.	[7M]
	b)	Derive the relation between α and β of a transistor.	[7M]

OR

6	a)	Describe the input and output characteristics of a transistor in CB configuration.	[7M]
	b)	Explain the mechanism of amplification in a transistor.	[7M]

UNIT-IV

7	a)	Draw a fixed bias circuit and explain its operation. Calculate the Stability factor.	[7M]
	b)	Sketch the basic circuit of a voltage amplifier and explain its action using load line analysis.	[7M]

OR

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8 a) Design a self bias circuit for the following specifications: V_{CC} = 12V; V_{CE} = 2V; I_C = 4mA; hfe = 80. Assume any other design parameters required. Draw the designed circuit. [7M]

b) Listout biasing techniques applied to the transistor? Mention their advantages and disadvantages. [7M]

UNIT-V

9 a) Why hybrid model is used for the analysis of BJT amplifier at low frequencies? Explain. [4M]

b) Determine Voltage Gain, Current Gain, Input resistance and Output resistance for a CE amplifier using NPN transistor with hie = 1200Ω, hre = 0, hfe = 36 and hoe = 2 x 10^{-6} mhos, R_L = 2.5kΩ and R_S = 500Ω (neglect the effect of biasing circuit) [10M]

OR

10 a) What is the significance of exact and approximate analysis? [5M]

b) Obtain the expression for current gain, voltage gain, input impedance and output impedance for Common Emitter Amplifier with Emitter Resistor. [9M]

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UNIT-I

1 a) Examine the energy band structure of PN junction diode. [7M]
b) Explain about the effect of temperature on diode characteristics. [7M]

OR

2 a) Define Hall effect? Give some application of Hall Effect. [7M]
b) A silicon diode has a saturation current of 7.5μA at room temperature 300K. Calculate the saturation current at 400K. [7M]

UNIT-II

3 a) With neat diagram explain about varactor diode. [7M]
b) Draw the circuit diagram and explain the working of full wave rectifier and derive the expression for ripple factor, voltage, PIV Transformer Utilization Factor. [7M]

OR

4 a) Explain the operation of tunnel diode and draw its equivalent circuit. [7M]
b) Compare various filter circuits in terms of ripple factors. [7M]

UNIT-III

5 a) Explain input and output characteristics of a transistor in CC configuration. [7M]
b) List the classification of FET family and explain each component in detail. [7M]

OR

6 a) Compare among CC,CB, CE configurations of a transistor amplifier in terms of current gain, voltage gain, input impedance, output impedance and few applications. [7M]
b) Derive an expression for drain current of FET in pinch off region with necessary diagram. [7M]

UNIT-IV

7 a) An NPN Silicon transistor with β=50 is used in a common emitter circuit with V_{CC}=10V, R_C=2K. The bias is obtained by connecting a 100K resistance from collector to base. Find i) Q-Point ii) Stability factor, S [8M]
b) Write about Thermal Stability. [6M]

OR

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8 a) Explain the basic requirements of transistor biasing. Verify these requirements in Emitter feedback bias circuit. [7M]

b) Design a collector to base bias circuit using silicon transistor to achieve a stability factor of 20, with the following specifications: V_{CC} = 16V, V_{BE} = 0.7V, V_{CEQ}= 8V, I_{CQ}= 4 mA & β= 50 [7M]

UNIT-V

9 a) The h parameters for the transistor are hie=1.1kΩ, hfe=99, hre=2.5x 10^{-4} and hoe=25 μA/V. Find the h parameters for common base and common collector configurations [7M]

b) Compare the three configurations of JFET amplifiers. [7M]

OR

10 a) Determine the parameters Ai , Ri , Av and R_0 of Emitter Follower using simplified hybrid model analysis. [7M]

b) Write the expressions for mid-frequency gain of a FET Common Source Amplifier. [7M]

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UNIT-I

1 a) Derive the expression for PN junction diode forward and reverse currents with suitable diagram and necessary explanation [7M]
b) Discuss about the following: [7M]
i. Law of junction
ii. Fermi Dirac function

OR

2 a) State and Prove Continuity equation. [7M]
b) Determine the current in a PN Junction. Consider a PN junction at T = 300 K in which Is = 10-14 A and n =1. Find the diode current for V_D = +0.70V and V_D = -0.70 V. [7M]

UNIT-II

3 a) Explain the equivalent circuit, V-I characteristics of UJT. [7M]
b) Explain the operation of a Half wave rectifier and its various parameters. [7M]

OR

4 a) Explain the operation of varactor diode. [6M]
b) A full wave rectifier circuit uses two silicon diodes with a forward resistance of 20Ω each. A DC voltmeter connected across the load of 1KΩ reads 55.4 volts. Calculate i) Irms ii) Average voltage across each diode iii) ripple factor iv) Transformer secondary voltage rating. [8M]

UNIT-III

5 a) Explain in detail about the Ebers Moll model. [7M]
b) Compare the difference between JFET & MOSFET [7M]

OR

6 a) With neat diagram explain the operation of MOSFET in Depletion mode and derive its current equations [7M]
b) Establish a relation between the three JFET parameters, μ, r_d and gm. [7M]

UNIT-IV

7 a) Mention the need for transistor biasing? Explain. [7M]
b) What is thermal runaway in transistors? Obtain the condition for thermal stability in transistors. [7M]

OR

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8 a) Discuss about the following: [6M]
i. DC load line ii. AC loadline

b) Discuss about Stabilization against variations in V_{BE}, Ic, and β. [8M]

UNIT-V

9 a) Draw the hybrid model for CE transistor and derive the parameters. [7M]

b) With the help of a neat schematic, explain the functioning of a common source amplifier. [7M]

OR

10 a) Obtain the expressions for current gain, voltage gain, input impedance and output impedance of CB amplifier using simplified hybrid model. [8M]

b) Compare the CE, CB and CC transistor amplifier parameters. [6M]