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

II B. Tech I Semester Regular/Supplementary Examinations, January-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)	Derive an expression for continuity equation and explain its importance.	[7M]
	b)	Define Fermi level and explain its significance in the energy band diagrams.	[7M]

OR

2	a)	Draw and explain the V-I characteristics of PN junction diode.	[7M]
	b)	The reverse bias saturation current for a P-N junction diode (Silicon type) is 2μA at 300K. Calculate the dynamic and static resistances at 100mV forward bias at 300K.	[7M]

UNIT-II

3	a)	Draw the symbol of Tunnel diode. Explain the construction and tunneling phenomenon of Tunnel diode.	[10M]
	b)	Explain how zener diode acts as a voltage regulator.	[4M]

OR

4	a)	With the help of neat circuit diagram, explain the operation of Bridge rectifier.	[8M]
	b)	Compare the performance of inductive, L-section and π-section filters.	[4M]
	c)	What is peak inverse voltage (PIV) of a diode in a rectifier circuit?	[2M]

UNIT-III

5	a)	Define α, β and γ of a transistor. Show how they are related to each other.	[4M]
	b)	Explain about transistor as an amplifier.	[5M]
	c)	Explain the operation of photo transistor.	[5M]

OR

6	a)	Explain the working of a depletion-type MOSFET.	[7M]
	b)	For n-Channel JFET, V_{DS}=10V and V_{GS} is changed from 3V to 4V and drain current changed -4mA to 2nA. Find g_m, r_d, and μ if V_{DS} changes from 8 to 12V and I_D changes from 3 to 3.2mA at V_{GS}=2.5V.	[7M]
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UNIT-IV

7	a)	Explain about the need for biasing in electronic circuits. What are the factors affecting the stability factor?	[6M]
	b)	A silicon transistor with β=70 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)	Define stability factor 'S'.	[2M]

OR

8	a)	Explain how the Q-point is obtained graphically.	[5M]
	b)	Explain diode compensation against variation in base-emitter voltage V_{BE}.	[6M]
	c)	In a silicon transistor circuit with a fixed bias, V_{CC} = 10V, R_C= 3KΩ, R_B = 6KΩ, β = 100, V_{BE} = 0.7V. Find the stability factor.	[3M]

UNIT-V

9	a)	What are the benefits of h-parameters?	[2M]
	b)	Draw the h-parameter equivalent circuit for a typical common base amplifier and derive expressions for A_i and A_v.	[8M]
	c)	Define the three small-signal parameters of the FET. How are they inter-related?	[4M]

OR

10	a)	Give the complete analysis of CE transistor amplifier circuit using h-parameters and derive the expressions for current gain, voltage gain, input impedance and output admittance.	[12M]
	b)	Draw the small signal model of FET.	[2M]

Code No: R2021041 **R20** SET - 2

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UNIT-I

1	a)	Explain about Hall effect.	[5M]
	b)	The Hall-coefficient of specimen doped silicon is found to be 3.66 x 10^{-4} m^3C; the resistivity of the specimen is 8.93 x 10^{-3} Ω-m. Find the mobility and density of charge carriers assuming single carriers conduction.	[4M]
	c)	Explain about Law of junction.	[5M]

OR

2	a)	Briefly explain about Open circuited p-n junction and Biased p-n junction.	[10M]
	b)	A silicon diode has a saturation current of 6.5 μA at room temperature 300K. Calculate the saturation current at 400K.	[4M]

UNIT-II

3	a)	Explain the construction and operation of SCR.	[8M]
	b)	Draw and explain the V-I characteristics of Varactor diode.	[6M]

OR

4	a)	With a neat sketch explain the operation of center tapped full wave rectifier and derive the expression for ripple factor.	[9M]
	b)	Determine the ripple factors of an L-section filter and Capacitive filter with C=40μF, V_{dc}=12V, R_L=10 KΩ, f=50Hz and L=10H used with FWR.	[5M]

UNIT-III

5	a)	Explain the various current components in BJT.	[7M]
	b)	Draw the Ebers-Moll model of a transistor for NPN transistor and explain the same.	[7M]

OR

6	a)	Define the following terms for a JFET: (i) The pinch-off voltage (ii) I_{DSS} (iii) I_{GSS} (iv) Drain resistance	[7M]
	b)	Explain the working of an enhancement-type MOSFET.	[7M]
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UNIT-IV

7 a) Draw the Fixed bias circuit and derive the expression for the stability factor S. What are the limitations of this circuit? [8M]

b) What is thermal runaway in transistors? Obtain the condition for thermal stability in transistors. [6M]

OR

8 a) Explain why bias stabilization is needed in a transistor amplifier circuit. [6M]

b) In a self biased circuit, the Q-point is established at V_{CE} = 12V and I_C = 2mA. Determine R_E, R_1 and R_2 so that $S(I_{C0})$ = 3. Assume β=50, V_{BE} = 0.7V, V_{CC}=22.5V [8M]

UNIT-V

9 a) Draw the small signal model of FET and explain the significance of each element. [5M]

b) A CE amplifier is drawn by a voltage source of internal resistance r_s = 700 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. [9M]

OR

10 a) Derive the expressions for voltage gain, current gain, input and output impedance of CC amplifier using exact and approximate analysis. [10M]

b) Give the comparison of transistor amplifiers. [4M]

Code No: R2021041 **R20** SET - 3

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UNIT-I

1	a)	Explain energy band diagrams of intrinsic and extrinsic semiconductors with neat sketches.	[7M]
	b)	Derive an expression for the Fermi level in an intrinsic semiconductor. Express electron and hole concentrations in terms of Fermi level.	[7M]

OR

2	a)	Calculate the barrier capacitance of a Germanium p-n junction whose area is 1mm by 1mm and space charge thickness is 2×10^{-4} cm. The dielectric constant of Germanium (relative to free space) is 16.	[7M]
	b)	Explain the effect of temperature on characteristics of PN junction diode.	[7M]

UNIT-II

3	a)	In what respect is an LED different form an ordinary PN junction diode? State the applications of LEDs.	[6M]
	b)	Discuss the operation of UJT with necessary diagrams.	[8M]

OR

4	a)	With neat sketch explain the operation of full wave rectifier with capacitor filter and derive the expression for ripple factor.	[10M]
	b)	In a half-wave rectifier circuit, a voltage of 12 sin ωt is applied. The diode has a forward resistance of 10Ω. The load is 1.5KΩ. Determine I_m and V_{dc}.	[4M]

UNIT-III

5	a)	Explain the operation of transistor in CE configuration and draw its input and output characteristics.	[10M]
	b)	A certain transistor has a current gain of 0.99 in CB configuration. Calculate its current gain in the CE configuration and another transistor has β=70, determine its α.	[4M]

OR

6	a)	Explain how a FET is used as a voltage variable resistor.	[5M]
	b)	Give the comparison between JFET and MOSFET.	[4M]
	c)	An n-channel JFET has I_{DSS} = 10mA and V_P = -2V. Determine the drain source resistance r_{DS} for (i) V_{GS} = 0V and (ii) V_{GS} = -0.5V.	[5M]
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UNIT-IV

7 a) Explain the importance of biasing. [4M]

b) Define the three stability factors. [3M]

c) Design a self-bias circuit using silicon transistor to achieve a stability factor of 10, with the following specifications: V_{CC}=15V, V_{BE}=0.7V, V_{CEQ}=8V, I_{CQ}=4 mA and β=50. [7M]

OR

8 a) Explain why the self-biasing arrangement cannot be used in an enhancement type MOSFET. [4M]

b) With a neat sketch, explain the operation of collector to base bias. [6M]

c) Explain how thermistor is used for bias compensation. [4M]

UNIT-V

9 Derive the expressions for voltage gain, current gain, input impedance and output impedance of CE amplifier using exact and approximate analysis. [14M]

OR

10 a) Define the various h-parameters and give their units. [3M]

b) Draw the h-parameter model for common collector configuration. [2M]

c) Deduce the expressions for input impedance, output impedance and voltage gain of Common Drain amplifier. [9M]

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UNIT-I

1 a) What is meant by Fermi level in semiconductor? Where does the Fermi level lie in an intrinsic semiconductor? Prove that the Fermi level in an n-type material is much closer to the conduction band. [7M]

b) Explain about Fermi-Dirac function. [7M]

OR

2 a) "The barrier potential developed across an open-circuited PN junction allows the flow of minority carriers". Explain how the current due to this flow of charge carriers is counterbalanced. [7M]

b) Explain about the current components in PN junction diode. [7M]

UNIT-II

3 a) Draw and explain the V-I characteristics of Photodiode. [6M]

b) A 10V zener diode is used to regulate the voltage across the variable load R_L. V_{DC} has the range $13V \leq V_{DC} \leq 16V$ and load current is $10\ mA \leq I_L \leq 85\ mA$. Given I_{zmin} as 15mA, calculate: (i) R_S and (ii) zener diode power dissipation P_Z. [8M]

OR

4 a) Sketch the circuit of a half-rectifier and explain its operation. [6M]

b) A sinusoidal voltage whose $V_m = 25V$ is applied to a half-wave rectifier. The diode may be considered to be ideal and $R_L = 1.5\ K\Omega$ is connected as load. Determine the following: [6M]
(i) Peak value of current
(ii) RMS value of current
(iii) Ripple factor

c) Define form factor. [2M]

UNIT-III

5 a) Draw and explain the input and output characteristics of BJT in common base configuration. [8M]

b) Explain about punch through/reach through in BJT. [6M]

OR

6 Explain the construction and operation of n-channel JFET with neat sketches. Discuss its drain and transfer characteristics. [14M]

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UNIT-IV

7 a) Explain why it is considered better to fix the quiescent operating point in the middle of the active region. [4M]

b) Give the comparisons among fixed, collector to base and self-bias circuits. [3M]

c) Explain about the transistorized bias compensation against the variation in base-emitter voltage V_{BE}. [7M]

OR

8 a) What are the limitations in selecting the operating region in a transistor circuit? [3M]

b) Draw the various biasing circuits used for JFET/MOSFET. [6M]

c) An N-channel JFET with V_P = 2.0V and I_{DSS} = 1.75mA is used in an amplifier, using self-bias circuit. It uses a drain-source supply V_{DD} = 25V. It is desired to bias the circuit at I_D=1mA. Find (i) V_{GS} and (ii) R_S. [5M]

UNIT-V

9 a) Determine the current gain and input impedance when the transistor is connected in CB configuration with a load R_L=10KΩ, V_{CB}=10V, I_C=1.5mA, h_{ib}=20Ω, h_{rb}=5x10^{-4}, h_{fb}= -0.98, h_{ob}=10^{-7} Ω^{-1}. [6M]

b) Deduce the expressions for input impedance, output impedance and voltage gain of Common Source amplifier. [8M]

OR

10 a) Explain in detail about the small signal analysis of Common Source FET amplifier. [10M]

b) Discuss the generalized analysis of transistor amplifier model using h-arameters. [4M]