

II B. Tech I Semester Regular Examinations, March - 2021
ELECTRONIC DIVICES AND CIRCUITS
 (Electronics and Communication 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) What is Hall effect? Derive the relation between mobility and hall coefficient? [8M]  
 b) Define a hole in a semiconductor? Indicate how a hole contributes to conduction pictorially? [7M]
- Or
- 2 a) Draw the band diagram of p-n junction diode? Define law of junction? [8M]  
 b) How many types of junction capacitances are there? Explain with neat diagrams? [7M]
- 3 a) Explain the two transistor analogy of an SCR. Draw the V-I characteristics of SCR? [8M]  
 b) What are the various filter circuits used in rectifiers. Compare their performance. [7M]
- Or
- 4 a) Derive the expressions for PIV, Ripple factor, Conversion Efficiency and TUF of a Full wave rectifier. [8M]  
 b) What is UJT and draw the Construction, operation of a UJT along with its characteristics? [7M]
- 5 a) Sketch a family of CE input and output characteristics for a transistor? Indicate the cutoff, active and saturation regions? [8M]  
 b) With the help of suitable diagrams, explain the working of n-channel enhancement MOSFET? [7M]
- Or
- 6 a) Tabulate comparisons of CB, CE and CC configurations with examples. [8M]  
 b) An n-channel JFET has  $I_{DSS} = 10\text{mA}$  and  $V_P = -2\text{V}$ . Determine the drain source resistance  $r_{DS}$  for (i)  $V_{GS} = 0\text{V}$ . (ii)  $V_{GS} = -0.5\text{V}$  [7M]
- 7 a) Define the stability factors S, S' and S'' and derive the relation between them. [8M]  
 b) Define Thermal runaway. Derive the necessary condition to avoid thermal runaway in a transistor? [7M]
- Or
- 8 a) Explain the necessity of biasing a Transistor. Derive the Q-point of a self-bias circuit. [8M]  
 b) Explain the stabilization of Q-point using sensistor and thermistor. [7M]
- 9 a) Derive simplified h parameter model of a transistor. State its advantages. Derive an expression for voltage gain of CE, CB and CC amplifiers using simplified h parameter model. [8M]  
 b) Describe the operation of common drain FET amplifier and derive the equation for voltage gain. [7M]
- Or
- 10 a) Draw the equivalent circuit of common source FET amplifier and derive the expression for voltage gain. [8M]  
 b) Draw low frequency model of FET and list out advantages over BJT. [7M]

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- 1 a) Derive the condition of dynamic equilibrium for the density of charge carries for continuity equation? [8M]
 b) Give the mathematical analysis and show that the Fermi energy level lies in the centre of forbidden energy band for an intrinsic semiconductor. [7M]

Or

- 2 a) Sketch neat diagram of I-V characteristics of p-n junction diode, and explain? Give the relation between current I and voltage V? [8M]
 b) For a Ge diode, the $I_0=2\mu\text{A}$ and the voltage of 0.26V is applied. Calculate the forward and reverse dynamic resistance values at room temperature. [7M]
- 3 a) Define and derive the terms as referred to HWR circuit. i) PIV ii) Average d.c. voltage iii) RMS current iv) Ripple factor. [8M]
 b) Explain the significance of Rectifiers with filters, and what are the advantages of capacitor filter over Inductor filter? [7M]

Or

- 4 a) Explain the Zener and Avalanche thermal breakdown mechanisms. What will be their thermal coefficients? [8M]
 b) Explain the principle and operation of tunnel diode with energy band diagrams? [7M]
- 5 a) Briefly discuss about the construction, working and static drain characteristics of enhancement MOSFET? [8M]
 b) Tabulate the comparisons between JFET and MOSFET? [7M]

Or

- 6 a) With suitable diagrams explain the input and output characteristics of a Common Emitter Configuration. [8M]
 b) Explain the operation of a Field effect Transistor. Derive an expression for pinch-off voltage of a FET. [7M]
- 7 a) Draw and explain the Fixed Bias Circuit. Explain why the circuit is unsatisfactory if the transistor is replaced by another of same type. [8M]
 b) Discuss clearly the diode and sensistor compensation techniques. [7M]

Or

- 8 a) What is the necessity of biasing circuits? Derive the expression for stability factor of self bias circuit. [8M]
 b) In a Silicon transistor circuit with a fixed bias, $V_{CC}=9\text{V}$, $R_C=3\text{K}\Omega$, $R_B=8\text{K}\Omega$, $\beta = 50$, $V_{BE}=0.7\text{V}$. Find the operating point and Stability factor. [7M]
- 9 a) Briefly explain about the JFET Small signal Model with the help of neat diagrams. [8M]
 b) Analyze Common Emitter amplifier with Re circuit using h-parameter model. [7M]

Or

- 10 a) Draw the exact h parameter model of a Transistor suitable for any configuration. [8M]
Derive expressions for voltage gain, current gain, input impedance and output impedance of an amplifier using exact h parameter model?
- b) Derive an expression for voltage gain of a Common Drain Amplifier. [7M]



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- 1 a) Explain the classification of Insulators, Semi conductors, and Metals using Energy Band Diagrams? [8M]  
 b) Sketch the piecewise linear characteristics of a diode. What are the approximate cut-in voltages for silicon and germanium? [7M]

Or

- 2 a) What do you mean by step graded junction? Derive the expression for diffusion capacitance. [8M]  
 b) Explain the temperature dependent characteristics of PN junction diode? [7M]  
 3 a) Explain the operation of Full Wave Rectifier with Induction filter with necessary diagrams. [8M]  
 b) A sinusoidal voltage whose  $V_m=26V$  is applied to half-wave rectifier. The diode may be considered to be ideal and  $R_L=1.2 K\Omega$  is connected as load. Find out peak value of current, RMS value of Current, DC value of current and Ripple factor. [7M]

Or

- 4 a) What is tunneling phenomena? Explain the principle of operation of tunnel diode with its characteristics. [8M]  
 b) Discuss the Principle of operation and draw characteristics of Silicon control rectifier (SCR). [7M]  
 5 a) Explain the operation of CC Configuration of BJT and its input and output characteristics briefly. [8M]  
 b) Draw and explain drain and transfer characteristics of depletion type MOSFET. [7M]

Or

- 6 a) With neat diagram explain the various current components in a p-n-p transistor. [8M]  
 b) What are the advantages of JFET over BJT? Justify JFET is the voltage control device. [7M]  
 7 a) Explain the need for biasing in electronic circuits. What are the factors affecting the stability factor. [8M]  
 b) Explain the DC and AC load Line analysis with the help of neat diagrams? [7M]

Or

- 8 a) Draw and explain the Voltage Divider Biasing with necessary examples? [8M]  
 b) A transistor with  $\beta = 100$  is to be used in Common Emitter Configuration with collector to base bias. The collector circuit resistance is  $R_C = 1k\Omega$  and  $V_{CC} = 10V$ . Assume  $V_{BE} = 0$ . [7M]  
 i) Choose  $R_B$  so that the quiescent collector to emitter voltage is 4V.  
 ii) Find the stability factor.

- 9 a) Draw the circuit diagram of CC amplifier using hybrid parameters and derive the expression for  $A_i$ ,  $A_v$ ,  $R_i$  and  $R_o$ . [8M]  
b) Explain and draw the common source FET amplifier and its equivalent circuit and derive the expressions for  $A_v$  and  $R_i$  [7M]

Or

- 10 a) Derive the expressions for Voltage gain and current gain for CE amplifier. [8M]  
b) For the Common Source Amplifier, calculate the value of the voltage gain, given [7M]  
i)  $r_d = 100\text{K}\Omega$ ,  $R_L = 10\text{K}\Omega$ ,  $g_m = 300\mu$  and  $R_o = 9.09\text{K}\Omega$ .  
ii) If  $C_{DS} = 3\text{pF}$ , determine the output impedance at a signal frequency of 1 MHz.



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- 1 a) Define diffusion and transition capacitance of p-n junction diode. Prove that diffusion capacitance is proportional to current I. [8M]  
 b) Obtain the static and dynamic resistances of the p-n junction germanium diode, if the temperature is  $27^{\circ}\text{C}$  and  $I_0=1\mu\text{A}$  for an applied forward bias of 0.2 V. Assume  $=1.38\times 10^{-23}\text{J}/^{\circ}\text{K}$ . [7M]
- Or
- 2 a) Derive the expression for Concentration of Hole and Electron in an intrinsic semiconductor and also draw the Fermi level position in intrinsic semiconductor. [8M]  
 b) State and prove continuity equation. [7M]
- 3 a) Draw the circuit diagram of full wave rectifier with L-section filter and explain its operation? [8M]  
 b) Explain the working of Tunnel diode and its V-I characteristics. And what is the sufficient condition for tunneling? [7M]
- Or
- 4 a) Construct Bridge rectifier circuit and derive equation for  $I_{\text{DC}}$ ,  $V_{\text{DC}}$ ,  $I_{\text{RMS}}$ ,  $V_{\text{RMS}}$ , and Rectifier efficiency. [8M]  
 b) With suitable diagrams explain the operation of varactor diode? [7M]
- 5 a) Explain input and output characteristics of transistor in CB configuration with neat diagram. [8M]  
 b) Describe the construction and working principle of Enhancement mode and depletion mode MOSFET and draw its characteristics. [7M]
- Or
- 6 a) Explain CE configuration with the help of input and output characteristics. [8M]  
 b) Draw the construction diagram, operation characteristics and parameters of JFET? [7M]
- 7 a) Write a short note on Stabilization against variations in  $V_{\text{BE}}$  and  $\beta$ . [8M]  
 b) List out different types of biasing methods. Derive the equation for stability factor for fixed bias. [7M]
- Or
- 8 a) Explain the terms Bias Stabilization and Bias Compensation. [8M]  
 b) Determine the quiescent currents and the collector to emitter voltage for a Ge transistor with  $\beta = 50$  in the self biasing arrangements. The circuit component values are  $V_{\text{CC}} = 20\text{V}$ ,  $R_{\text{C}} = 2\text{k}\Omega$ ,  $R_{\text{e}} = 0.1\text{ k}\Omega$ ,  $R_1 = 100\text{ k}\Omega$  and  $R_2 = 5\text{ k}\Omega$ . Find the stability factor S. [7M]

- 9 a) For CG amplifier, draw the small signal equivalent circuit and determine expression for gain, input impedance and output impedance? [8M]  
b) Draw the small signal equivalent circuit of FET amplifier in CS connection and derive the equations for voltage gain, input impedance and output impedance? [7M]
- Or
- 10 a) Draw the circuit of source follower Amplifier and derive the expressions for  $A_i$ ,  $A_v$ ,  $R_i$  and  $R_o$ . [8M]  
b) Draw the Common emitter amplifier with Emitter resistor and explain its operation. [7M]

