

CODE NO: A109210203

R09

SET - 1

## II B.TECH - I SEMESTER EXAMINATIONS – MAY, 2011

## ELECTRONIC DEVICES AND CIRCUITS

(Common to EEE, ECE, CSE, EIE, BME, IT, MCT, ECC, ETM, ICE)

Time: 3hours

Max. Marks: 75

Answer any FIVE questions  
All Questions Carry Equal Marks

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- 1.a) Explain the V-I characteristics of Zener diode and distinguish between Avalanche and Zener Break downs.
- b) In a Zener diode regulator, the supply voltage = 300V,  $V_z = 220V$ ,  $I_z = 15mA$  and load current = 25mA. Calculate the value of resistor required to be connected in series with the Zener diode. [7+8]
- 2.a) Derive the expression for the ripple factor of  $\pi$ -Section filter when used with a Half-wave-rectifier. Make necessary approximations.
- b) Draw the circuit of bridge rectifier and explain its operation with the help of input and output waveforms. [7+8]
- 3.a) Explain different current components in a transistor.
- b) Write short notes on Early effect.
- c) Draw input and output characteristics of a transistor in common emitter configurations. [5+5+5]
- 4.a) Why a transistor needs biasing? Explain.
- b) Draw the self bias circuit and obtain the expression for the stability factor. Discuss the advantages and disadvantages of self biasing. [7+8]
- 5.a) For the transistor connected in CE configuration, determine  $A_v$ ,  $A_i$ ,  $R_i$  and  $R_o$  using the complete hybrid equivalent model. Given  $R_L = R_S = 1K\Omega$ ,  $h_{ie} = 1K\Omega$ ,  $h_{re} = 2 \times 10^{-4}$ ,  $h_{fe} = 100$ ,  $h_{oe} = 20 \mu A/V$ .
- b) Draw the circuit diagram of CC amplifier using hybrid parameters and derive expressions for  $A_i$ ,  $A_v$ ,  $R_i$ ,  $R_o$ . [8+7]
- 6.a) Sketch the drain characteristics of MOSFET for different values of  $V_{GS}$  & mark different regions of operation.
- b) Give the construction details of JFET and explain its operation. [8+7]
- 7.a) Write short notes on applications of FET as a voltage variable resistor.
- b) Explain the principle of CS amplifier with the help of circuit diagram. Derive the expressions for  $A_v$ , input impedance and output impedance. [7+8]
- 8.a) Explain the tunneling phenomenon. Explain the characteristics of tunnel diode with the help of necessary energy band diagrams.
- b) What is the photo diode? Explain its principle of operation and applications in detail. [8+7]

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- 1.a) Explain the effect of temperature on V-I characteristics of a diode.
- b) Distinguish between drift and diffusion current in a semiconductor. State continuity equation. [7+8]
- 2.a) Draw the circuit of a half-wave-rectifier and find out the ripple factor, % regulation, efficiency and PIV.
- b) Compare the performance of Inductor filter and capacitor filter. [8+7]
- 3.a) Draw the circuit diagram of a transistor in CB configuration and explain the output characteristics with the help of different regions.
- b) In a germanium transistor collector current is 51mA, when current is 0.4mA. If  $h_{fe} = \beta_{dc} = 125$ , Calculate cut off current,  $I_{CEO}$ . [7+8]
- 4.a) What are the compensation techniques used for  $V_{BE}$  and  $I_{CO}$ . Explain with help of suitable circuits.
- b) Draw a fixed bias circuit and explain its operation. [8+7]
- 5.a) Compare the three transistor amplifier configurations with related to  $A_I$ ,  $A_V$ ,  $R_i$  and  $R_o$ .
- b) For the emitter follower with  $R_S = 0.5K$ ,  $R_L = 50K$ ,  $h_{fe} = -50$ ,  $h_{ie} = 1K$ ,  $h_{oe} = 25\mu A/V$ ,  $h_{re} = 1$ . Calculate  $A_V$ ,  $A_I$ ,  $Z_i$  and  $Z_o$ . [7+8]
- 6.a) Explain the working of MOSFET in
  - i) Enhancement mode
  - ii) Depletion mode.
 Draw the necessary diagrams and graphs.
- b) Explain the operation of FET with its characteristics and explain the different regions in transfer characteristics. [8+7]
- 7.a) Give the construction details of UJT & explain its operation with the help of equivalent circuits.
- b) Compare BJT & FET. [7+8]
- 8.a) Write in detail:
  - i) Varactor diode
  - ii) Schottky Barrier diode
 with necessary sketches. [7+8]

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- 1.a) What is potential energy barrier of the p-n junction? How does it arise and what is its order of magnitude?
- b) Sketch the V-I characteristics of p-n junction diode for forward bias voltages. Distinguish between the incremental resistance and the apparent resistance of the diode. [7+8]
2. With suitable diagrams, explain the working of centre-tapped full wave rectifier. Derive expressions for  $V_{DC}$ ,  $I_{DC}$ ,  $V_{rms}$  and  $I_{rms}$  for it. [15]
- 3.a) Explain the constructional details of Bipolar Junction Transistor.
- b) Explain Current Amplification in CE configuration. [8+7]
- 4.a) Explain Voltage Divider biasing of a transistor.
- b) Define the stability factors with respect to the changes in  $I_{CO}$ ,  $V_{BE}$  and  $\beta$ . Why is the stability with respect to changes in  $V_{CE}$  not considered? [7+8]
- 5.a) Define the hybrid parameters for a basic transistor circuit in any configuration and give its hybrid model.
- b) For the h-parameters of a transistor, show that

$$h_{fb} = -\frac{h_{fe}}{1+h_{fe}} \quad \text{and} \quad h_{ob} = \frac{h_{oe}}{1+h_{fe}} \quad [7+8]$$

- 6.a) The field effect transistor is called a voltage-sensitive electronic control device. Explain why is the case?
- b) Name and define the circuit parameters of the JFET. How are they related to each other? [8+7]
- 7.a) Write the expressions for mid-frequency gain of a FET Common Source Amplifier.
- b) Discuss the high frequency response of CD Configuration. [8+7]
- 8.a) Explain the construction and working of photo diode.
- b) Sketch the static characteristics and firing characteristics of SCR and explain the shape of the curve. [8+7]

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- 1.a) Explain in detail, the reason for exponential rise in forward characteristic of a diode with suitable mathematical expression.
- b) Explain in detail, the variation of following semiconductor parameters with temperature,  
i) Energy gap ii) Conductivity. [7+8]
- 2.a) Explain the working of Bridge rectifier with necessary sketches and parameters.
- b) Explain the relative merits and demerits of all the rectifiers. [8+7]
- 3.a) Draw the energy variation curve in the conduction band for an open circuited n-p-n transistor. How is the curve modified when the transistor is operating in active region?
- b) A silicon n-p-n transistor with  $\alpha = 0.995$  and  $I_{CO} = 15 \text{ nA}$ , operates in the CE configuration. What is the collector current for a base current of  $20 \mu\text{A}$ ? [8+7]
- 4.a) What do you mean by the quiescent point of transistor amplifier?
- b) What is a load line? Explain its significance.
- c) Find the Q-point of self-bias transistor circuit with the following specifications:  
 $V_{CC} = 22.5\text{V}$ ,  $R_L = 5.6\text{k}\Omega$ ,  $R_C = 1\text{k}\Omega$ ,  $R_1 = 90\text{k}\Omega$ ,  $R_2 = 10\text{k}\Omega$ ,  $V_{BE} = 0.7\text{V}$  and  $\beta = 55$ .  
Assume  $I_B \gg I_{CO}$ . [5+5+5]
- 5.a) Draw the low frequency hybrid -  $\Pi$  model and explain the meaning of each component of a model.
- b) A given transistor with  $I_C = 10\text{mA}$ ,  $V_{CE} = 10\text{V}$  and at room temperature has the following set of low frequency parameters:  $h_{ie} = 500\Omega$ ,  $h_{oe} = 10^{-5}\text{A/V}$ ,  $h_{fe} = 100$ ,  $h_{re} = 10^{-4}$ . Find the values of all the hybrid -  $\Pi$  parameters of a low frequency model. [7+8]
- 6.a) Bring out neat comparison between JFET and MOSFET.
- b) List the advantages and disadvantages of FET over MOSFET. [7+8]
- 7.a) What is the effect of external source resistance on the voltage gain of a common source amplifier? Explain with necessary derivations.
- b) How a small signal high frequency model is different from a low-frequency model? Explain it briefly. [7+8]
- 8.a) Explain the working of Tunnel diode with help of energy band diagrams.
- b) Explain Schottky diode with necessary sketches. [7+8]

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