

THAPAR INSTITUTE OF ENGINEERING AND TECHNOLOGY, PATIALA
END SEMESTER EXAMINATION, Dec 2006
SEMICONDUCTOR DEVICES (ES 202)

13

Time allowed : 3 hrs

M.M: 36

NOTE: Attempt any six questions out of eight

Attempt parts of the same question in sequence

Assume any missing data suitably

See your answer sheets on 16 December, 2006 at 5.00 PM in L-212 (ECE deptt)

- 1.Q a) Explain the V-I characteristics of an ideal and practical PN junction diode with diagram. (3)
- b) Find the concentration of holes and electrons in P type Si at 300K if $\sigma = 100 \text{ (ohm cm)}^{-1}$.
 $n_i = 1.5 \times 10^{10} / \text{cm}^3$, $\mu_p = 500 \text{ cm}^2/\text{Vs}$, $\mu_n = 1300 \text{ cm}^2/\text{Vs}$. (1.5)
- c) Explain voltage regulation in Zener Diode? Draw the circuit Diagram also. (1.5)
- 2.Q a) Explain input and output characteristics of a CB transistor with properly labeled diagrams defining all the regions properly. (4)
- b) Explain transistor switching with diagrams clearly showing all the different time parameters involved. (2)
- 3.Q a) Define the stability factor, S? (1)
- b) Define thermal runaway? (1)
- c) Explain early effect in transistors? (1)
- d) A pnp transistor with $\beta = 50$ is used in CE configuration with $V_{CC} = 10\text{V}$, $R_C = 2\text{Kohm}$. The bias is obtained by connecting a 100Kohm resistor from Collector to base. Assume $V_{BE} = 0\text{V}$. Calculate S. (1)
- e) Draw the DC load line for the fixed bias CE configuration if $R_C = 80 \text{ ohm}$, $V_{CC} = 24\text{V}$. (2)
- 4.Q a) Derive the following parameters of a transistor amplifier using h-parameters
 i) Current gain, A_i ii) Voltage Gain, A_v iii) Input Impedance, Z_i iv) Output admittance, Y_o (4)
- b) In a CB transistor amplifier $h_{ib} = 30 \text{ ohm}$, $h_{fb} = 4 \times 10^{-6}$, $h_{rb} = -0.99$, $h_{ob} = 8 \times 10^{-7} \text{ (ohm)}^{-1}$,
 $R_L = R_S = 20\text{K ohm}$. Find A_i , A_v , Z_i , Y_o (2)
- 5.Q a) Explain the enhancement type MOSFET with construction and drain characteristics. (4)
- b) A JFET has $V_p = -4.5 \text{ V}$, $I_{DSS} = 10\text{mA}$, $I_{DS} = 2.5\text{mA}$. Determine V_{GS} . (1)
- c) Why FETs are called unipolar devices. (1)
- 6.Q a) Explain full wave rectifier working with neatly labeled diagram. Derive the ripple factor and efficiency for this. (4)
- b) Find the value of inductance to use the inductor filter connected to a full wave rectifier operating at 60 HZ to provide a DC output with 4% ripple factor for a 100 ohm load. (2)
- 7.Q a) Explain the hybrid pi CE transistor model with suitable diagram. (3)
- b) Explain the linear IC regulators? (3)
- 8.Q Write short notes (with diagrams wherever necessary)
- a) Intrinsic and extrinsic semiconductor
- b) π filter
- c) Depletion and transition capacitance of a diode. (2+2+2)