Bengal Engineering & Science University, Shibpur
B. E. (CST) 3rd semester Final Examination, 2011

Subject: ELECTRONICS DEVICES AND CIRCUITS (ET 305)

Time: 3hrs Full Marks: 70

Answer any three questions from each group:
[2 marks are reserved for neatness in each half]

First Half

1 a. What is the limitation of four-probe resistivity measurement? How it can be overcome?
b. What is hot probe method? Explain the principle of operation and limitation.
c. Show that the Fermi energy level is close to the valence band in a p type semiconductor.

(4+3+4)

2 a. If a battery is connected across a n-type semiconductor, show the conduction band, valence band, intrinsic energy level and Fermi level bending with respect to the direction of the electric field. Explain the result.
b. Explain the mechanism of formation of a p-n junction. Draw the band diagram and the electrostatic potential energy diagram of a PN junction with reason. Define contact potential and depletion width.

(5+6)

3 a. How Zener diodes act as voltage regulators?
b. For a symmetric square pulse voltage across a non-ideal diode (forward bias resistance R_f and reverse bias resistance as R_r) and a passive resistor R in series, plot the current through the circuit with time-explain.
c. State the assumptions in deriving conventional diode equation.

(4+5+2)

4 a.Draw an equivalent small signal model of a MOS transistor for low frequency region. Explain the physical significance of all the model parameters.
b. The threshold voltage of a MOSFET is constant when it is conducting. True or false? Explain with suitable reasons
c. What are the different capacitances present in a MOS transistor structure?

(5+3+3)

5 a. Derive the expression of base current of a BJT in terms of the device parameters.
b. What do you understand by short channel effects in MOS transistors?
c. What information about the MOS transistor can be obtained from its CV characteristics?

(5+3+3)

2nd Half

6 a. Draw the circuit diagram for the collector-to- base bias arrangement of a n-p-n transistor in CE configuration and explain the operation principle. Explain the stability factors with respect to the changes in I_{CO}, V_{BE}, and β of this circuit.
b.Draw the Hybrid parameter equivalent circuit representation of common emitter BJT amplifier and derive the expression for current and voltage gain. Find out their approximate expressions.
c. Explain the operation of Darlington Pair connection for BJT.

(4+5+2)

7 a.Write down the special features of a power transistors?
b.Sketch the circuit of a transformer-coupled classA power amplifier and explain its operation. Derive the expression for the conversion efficiency.
c. Discuss its advantages over class A power amplifier?

(2+7+2)

8 a. Explain Bharkhausen's criteria for oscillation.
b.Draw the circuit diagram of Wien-bridge Oscillator and explain operation. Derive the expression for frequency of oscillation. How the condition of sustaining oscillation is satisfied.
c.How quartz crystal is used as oscillator? Draw the electrical equivalent circuit. Find the expression of series and parallel resonant frequency? Why such oscillators are popular?

(2+5+4)

9 a. What do you understand by monolithic integrated circuit? Describe the different processes for its fabrication. What do you understand by SSI, MSI, LSI and VLSI?
b. Draw the circuit diagram of double-ended input and output differential amplifier. Explain its DC and AC analysis. Define common mode rejection ratio.

(2+5+4)

10. Explain the principle of operation of following operational amplifier circuits with suitable diagram

(i) Non-Inverting voltage amplifier
(ii) Inverting voltage amplifier
(iii) Integrator
(iv) Summing amplifier

(3+3+3+2)