53 (CE 201) BSEL

2014

BASIC ELECTRONICS

Paper : EC 201

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* What do you mean by a semiconductor ? Describe the covalent bond formation in germanium. 3

   (b) What do you understand by intrinsic and extrinsic semiconductor ? With the help of diagram explain how holes contribute to electric current in *P*-type semiconductor.

   3

(c) Explain the behaviour of a *P-N* junction under forward and reverse biasing. 8

(d) Explain the following terms : 3×2=6

(i) Ideal Diode

(ii) Knee Voltage

(iii) Dynamic Resistance.

2. (a) What do you mean by rectification ? Explain the principle of operation of a full-wave rectifier. Draw the waveforms of the diode current and load voltage for a sinusoidal input voltage applied to full wave rectifier. Derive the expression for average *DC* load current (I_{DC}) and average *DC* load voltage (E_{DC}) for F.W.R. 10

(b) Distinguish between a half-wave and a full-wave rectifier. 5

(c) The positive shunt clipper shown in figure has the input waveform as indicated. Determine the value of V_0 for each of the input alternations. The silicon diode has $V_T = 0 \cdot 7V$.   5
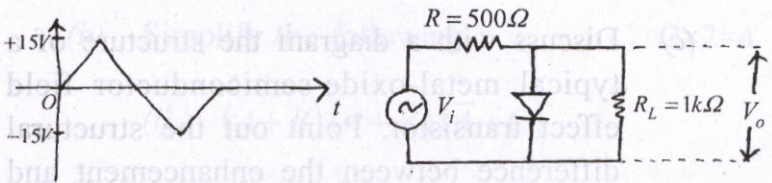
3. *(a)* Explain the word transistor. Clearly show the biasing arrangement of a PNP and NPN transistor for conduction.   5

(b) Define α and β of a transistor. Give the relationship between α, β and prove it.   5

(c) If the base current in a transistor is $20\mu A$ when the emitter current is $6 \cdot 4mA$, what are the values of α and β? Also calculate the collector current.   5

(d) What do you understand by transistor biasing ? Describe the voltage divider biasing method in detail.   5

4. *(a)* With a neat sketch, describe the construction of an *n*-channel JFET. Explain its principle of operation and also show static and transfer characteristics. 12

   (b) Deduce the relationship $\mu = r_d g_m$. 3

   (c) Discuss with a diagram the structure of a typical metal-oxide-semiconductor field effect transistor. Point out the structural difference between the enhancement and depletion forms of the MOSFET. 5

2.

5. *(a)* With a neat diagram, explain the working of a *R-C* phase shift oscillator. 5

   (b) A Hartley oscillator circuit has $L_1 = L_2 = 100 \mu H$. The frequency of oscillations required is $50kHz$. Calculate value of the capacitance required. 5

   (c) For a non-inverting amplifier using *OP-amp*, derive the expression for voltage gain with feedback. 5

   (d) List the important characteristics of an ideal *OP-amp*. What is CMRR ? 5

6. (a) Perform the following operations : $3\times2=6$

(i) Convert $(125)_8$ to binary

(ii) $(1C00)_{16}$ to decimal

(iii) $(8000)_{10}$ to hexadecimal.

(b) Simplify the following : $2\times2=4$

(i) $(A+B)(A+\bar{B})(\bar{A}+C)$

(ii) $AB+(\overline{\bar{A}+B})+AC$

(c) The Boolean expressions of the two variables X and Y in terms of the three inputs A, B and C are given by 5

$$X = ABC + A\bar{B}\bar{C} + \bar{A}B\bar{C}$$

$$Y = (\bar{A}+\bar{B}+\bar{C})\cdot(\bar{A}+B+C)\cdot(A+\bar{B}+C)$$

What is the relationship b/w X and Y ?

(d) Explain the importance of flip-flops in a digital system. What is S-R flip-flop ? Give its logic symbol and the truth table. 5

7. Write short notes on : *(any four)*   4×5=20

   (i)   Avalanche and Zener effect

   (ii) Colpitt's Oscillator

   (iii) C.R.O.

   (iv) Wein Bridge Oscillator

   (v)   Filters

   (vi) LCD display.