BRAINWARE UNIVERSITY

Course – B. Sc. (HN)

Introduction to Electrical circuits and Basic Electronics I (EC101 / BHNG101)

(Semester – 1)

Time allotted: 3 Hours   **Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Questions)   10x 1 = 10

1.   *Choose the correct alternative from the following*
(i)   i) The cut-in voltage of Si p-n junction diode is about
   a. 0 V   b. 0.2V
   c. 1.3V   d. 0.7V

(ii)   The efficiency in case of maximum power transfer theorem is
   a. 100 %   b. 50 %
   c. less than 50 %   d. greater than 50 %

(iii)   The ideal dynamic resistance of Zener diode is
   a. 0Ω   b. 1KΩ
   c. 5KΩ   d. Infinite

(iv)   In 1N 4007,   '1N' means
   a. Number   b. 1V
   c. Junction   d. None of these

(v)   7000 micro amperes, will be equivalent to
   a. 0.007 amp   b. 0.7 amp
   c. 7 amp   d. 700 amp

(vi)   If α =0.99 then β equals
   a. 9.9   b. 0.99
   c. 99   d. 199

(vii) What is the unit of CR where 'C' is capacitance of capacitor and 'R' is resistance of resistor

    a. Sec   b. Ohm

    c. Henry   d. None of these

(viii) Three resistors of 4 ohm, 6 ohm and 8 ohm are connected in parallel. Their equivalent resistance will be

    a. 4 Ohm   b. 2 Ohm

    c. 2.5 Ohm   d. 1 Ohm

(ix) The intrinsic carrier concentration of a semiconductor at 0 K is

    a. Zero   b. Infinity

    c. $10^{10}\,m^{-3}$ d. $10^{15}\,m^{-3}$

(x) Which among the following is regarded as 'Dual of Thevenin's Theorem'

    a. Norton's Theorem   b. Superposition Theorem

    c. Maximum Power Transfer Theorem   d. None of these

Group – B

(Short Answer Type Questions)   3 x 5 = 15

Answer any *three* from the following

2. Name the two mechanisms which cause break down in Zener diode. Discuss those.   [5]

3. Find out the relation between α and β for a transistor where notations have their usually meanings.   [5]

4. Drawing the circuit diagram of a Bridge rectifier, explain its action.   [5]

5. Two capacitors of capacitances C_1 and C_2 are joined in series and this combination is placed in parallel with a capacitor of capacitance C_3. Find the equivalent capacitance of the combination.   [5]

6. Draw circuit diagrams for different modes of operation relating to both n-p-n and p-n-p transistors.   [5]

Group – C

(Long Answer Type Questions)   3 x 15 = 45

Answer any *three* from the following

7. (a) Illustrate the distinction between metal, semiconductor and insulator in the framework of energy band theory.   [7]

(b) Explain the effect of acceptor and donor impurities in p-type and n-type semiconductors respectively by drawing the energy band diagrams.   [5]

(c) At 300K, the intrinsic concentration of silicon is 1.5×10^{16} m^{-3}. If the electron and the hole mobilities are 0.13 m^2/(Vs) and 0.05 m^2/(Vs) respectively, determine the intrinsic conductivity and resistivity of silicon at 300K.   [3]

8. (a) Formulate the growth of current in a circuit which contains inductance and resistance in series and is being fed by d.c source.   [5]

(b) What is the time constant? Draw I vs t graph for two time constants λ_2 and λ_1 when λ_2 is greater than λ_1. What is the unit of time constant?   [2+2+1]

(c) Derive the expression of the ratio of secondary voltage and primary voltage in terms of turn's ratio for a transformer.   [5]

9. Write short notes on   [5+5+5]
 i) Light-emitting diode   ii) Solar cell   iii) Photo diode

10. (a) Find out the condition of maximum power transfer to the external resistance (load) of a circuit.   [5]

(b) State Thevenin's theorem and show how the values of R_{Th} and V_{Th} are found.   [5]

(c) Calculate R_{Th} and V_{Th} with respect to the load terminal.   [5]
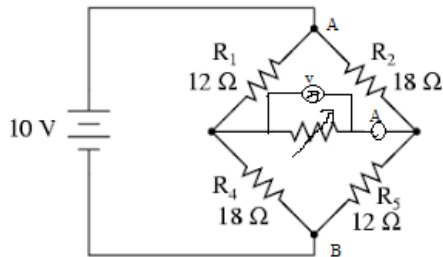
11. (a) Draw the circuit diagrams of both forward-biased and reverse-biased junction diodes. Write down the current voltage relationship for a p-n junction diode. Draw the corresponding curve. Define the static resistance and the dynamic resistance of p-n junction diode. What is the origin of reverse saturation current in p-n junction diode?   [2+2+2+2+2]

(b) The current flowing through a p-n junction silicon diode is 90 mA for a forward bias of 0.9 V at 300 K. Determine the static and dynamic resistance.(Given Boltzmann constant (k) = 1.38 X 10^{-23} J/K)   [1+4]