ALIAH UNIVERSITY

B.Tech End Semester (Odd) Examinations 2021
Subject– Basic Electronics Engineering (ESC ECEUGES01)
CSE , CEN, MEN 1st Year 1st SEM

Full Marks : 80   **Time-3 hrs**

_____
(Answer any five)

1. (i) Briefly explain the formation of energy band in solid state materials.
    (ii) Distinguish between insulator , semiconductor and metal on the basis of energy band diagram.
    (iii)Differentiate between intrinsic and extrinsic semiconductor.   (6+6+4)

2. (i) How is an n-type semiconductor formed ?
    (ii) Explain the Fermi-Dirac distribution function with graphical interpretation.
    (iii) Show that in n-type semiconductor the Fermi level energy E_F is close to the conduction band edge E_C of the band diagram.   (3+8+5)

3. (i) Show that equilibrium concentrations of electrons (n_0) and holes (p_0) in a semiconductor can be expressed as :- (symbols have usual meaning)

    (a) $n_0 = N_c e^{-\left(\frac{E_c - E_F}{KT}\right)}$ (b) $p_0 = N_v e^{-\left(\frac{E_F - E_v}{KT}\right)}$

    (ii) Show that the product of electron and hole concentrations under equilibrium is constant and can be expressed as :- $n_0 p_0 = n_i^2$.   (symbols have usual meaning)   (6+6+4)

4. (i) Explain the formation of the depletion region and barrier potential V_0 in a p-n junction diode.
    (ii) Show that the barrier potential can be expressed as :-   (symbols have usual meaning)
    $$V_0 = \frac{KT}{q} \ln \frac{N_a N_d}{n_i^2}$$
                (4+4+8)

5. (i) Explain the operation of the clipper circuit with the input shown in **Fig. 1**, assuming the diode as ideal diode.
    (ii) Find out the changes in the output voltage waveform if the diode is a real one with cutin voltage v_γ and diode dynamic resistance r_d after estimating the output voltage expression.
    (iii) Draw and explain the output of the circuit shown in **Fig. 2** for the given input.   (5+5+6)

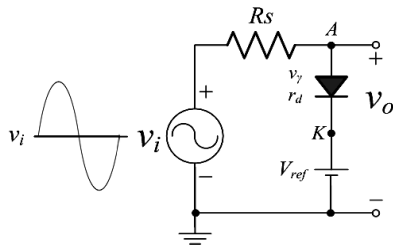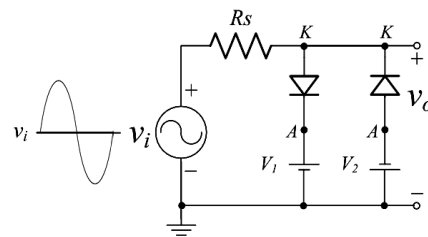Fig. 1   Fig. 2

6. (i) Explain the operation of full wave rectifier circuit with bridge network with a output waveform diagram.
    (ii) Show that the output DC voltage (V_{dc}) and ripple factor (Γ) of full wave rectifier output is
    (a) $V_{dc} = 0.636\, V_m$ (b) $\Gamma = 48.3\,\%$
                (4+5+3+4)

7. (i) Explain different current components in a p-n-p transistor in active region with a suitable diagram.
(ii) Establish the relation between current amplification factors α and β.   (6+4+6)
(iii) Briefly explain the CB, CE and CC mode operation in a transistor.

8. (i) Draw the output characteristics of CE amplifier and explain it.
  (ii) With neat diagram explain the fixed bias circuit of CE amplifier.
 (iii) Draw the DC load line and Q-points of the CE amplifier circuit. Why is the Q-point need to remain in the middle of the load line?   (4+4+6+2)

9. Find the input-output relation of the circuits shown in Fig. 3 and Fig. 4.   (8+8)
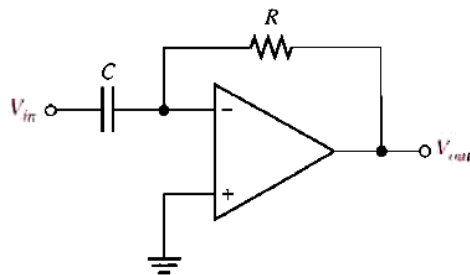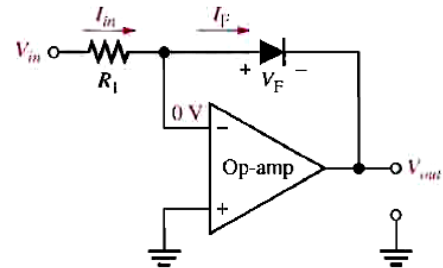

Fig. 3   Fig. 4

--END--