

B.Tech. / B.E. Electronics & Communication/Telecommunication Engineering  
(Model Curriculum) Semester-III  
**102 / 002 - Electronics Devices**

P. Pages : 2

Time : Three Hours



**GUG/W/23/13907**

Max. Marks : 80

- Notes :
1. All questions carry as indicated marks.
  2. Assume suitable data wherever necessary.
  3. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Derive the expression for the current density in terms of concentration of electrons, electron charge, mobility and electric field density. 8  
b) Explain the term mobility and drift velocity. 4  
c) Differentiate between intrinsic semiconductor and extrinsic semiconductor. 4

**OR**

2. a) Find the concentration of holes and electrons in a p-type silicon at 300°k, assume resistivity as  $0.02\Omega\text{-cm}$ ,  $\mu_p = 475\text{cm}^2/\text{v-sec}$   $n_i = 1.45 \times 10^{10}\text{ per cm}^3$  8  
b) Explain how the carrier concentration in p-type and n-type material can be determined using mass action law. 8
3. a) What is diffusion capacitance. Derive the mathematical expression of diffusion capacitance. 8  
b) The diode current is 0.6mA when the applied voltage is 400mV and 20mA when the applied voltage is 500mV. Determine  $\eta$ . Assume  $\frac{kT}{q} = 25\text{mV}$ . 8

**OR**

4. a) What do you mean by Zener diode. Explain how Zener diode maintain constant voltage across the load. 8  
b) Explain static and dynamic resistance of diode with their mathematical expression. 8
5. a) Derive the expression for  $I_{dc}$ ,  $\eta$  and PIV of full wave bridge rectifier. 8  
b) What is ripple factor. Prove that the ripple factor of half wave rectifier is 1.21. 8

**OR**

6. a) A full wave bridge rectifier with a 120V rms sinusoidal input has a load resistance of  $1k\Omega$  8
  - i) If silicon diodes are employed what is the dc voltage available at the load.
  - ii) Determine the required PIV rating of each diode.
  - iii) Find the maximum current through each diode during conduction.
  - iv) What is the required power rating of each diode.

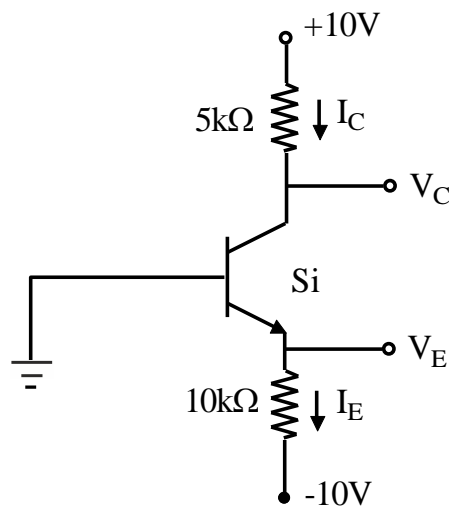
- b) Compare HWR, FWR and BWR. 8
7. a) Draw and explain the input and output characteristics of common emitter configuration of transistor. 8
- b) Calculate the collector currents and emitter current of a transistor with  $\alpha_{dc} = 0.99$  and  $I_{CEO} = 100\mu A$  when the base current is  $10\mu A$ . 8

**OR**

8. a) Draw and explain drain and transfer characteristics of n-channel JFET. 8
- b) A transistor has  $I_B = 105\text{ mA}$  and  $I_C = 2.05\text{ mA}$  Find. 8
- i)  $\beta$  of the transistor
- ii)  $\alpha$  of the transistor
- iii) Emitter current  $I_E$
- iv) Now if  $I_B$  changes by  $+27\text{mA}$  and  $I_C$  changes by  $0.65\text{mA}$  find the new value of  $\beta$ .
9. a) Prove that self bias method is the best bias by way of derivation. 8
- b) Explain Bias compensation using diode and thermistor. 8

**OR**

10. a) Draw and explain collector to base bias method with emitter resistance  $R_E$ . 8
- b) In the circuit shown the emitter voltage is  $-0.7\text{V}$ . If  $\beta_{dc} = 50$  find 8
- i)  $I_E$  ii)  $I_B$  iii)  $I_C$  iv)  $V_C$



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