c) Why N-Channel MOSFETs preferred over P-Channel MOSFETs? 5+4+5=14

10. a) With the help of neat sketch explain the construction of depletion and enhancement type N-channel MOSFETs.

b) Why MOSFETs are never connected or disconnected in the circuit when power is ON.c) How FETs and conventional BJTs are different from each other? 7+2+5=14

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M. Tech Odd Semester Examination, February, 2023

Electronics & Communication Engineering

(1st Semester)

Course No.: MECE-101

(Semiconductor Device Physics)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

Note:
1. Attempt 05 (Five) questions by taking one form each unit.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the right margin indicate full marks for the question.

UNIT-I

1. a) Define Fermi level for metal. Show that for intrinsic semiconductor Fermi level is midway between conduction and valance bands.

b) What happens when the N-type material is made more positive than the P-type material by an external voltage source? What ultimately happens if the voltage is gradually increased? (2+7)+(3+2)=14

2. a) Differentiate drift current and diffusion current.

b) Explain in context to semiconductor, doping and its need.

c) Find the diffusion coefficients of holes and electrons for germanium at 300^0K . The carrier

motilities in cm^2/Vs at 300^0K for electrons and holes respectively 3600 and 1700.Density of carrier is $2.5\,X\,10^{13}/\,cm^2$. 5+5+4=14

UNIT-II

3. a) What is meant by 'static resistance and 'dynamic resistance' of a junction diode?

   b) A potential difference of 10V is applied longitudinally to a rectangular specimen of intrinsic germanium of length 25mm, width 4mm, and thickness 1.5mm. Determine at room temperature –

   (i) Electron and hole drift velocity

   (ii) The conductivity of intrinsic germanium if intrinsic carrier density is $2.5\,X\,10^{19}/\,m^2$

   (iii) The total current. 5+(3+3+3)=14

4. a) Write the differences between light sensitive and light generated device.

   b) Distinguish between avalanche and zener breakdown of P-N diode.

   c) Explain how zener diode can be used as a voltage regulator. 4+4+6=14

UNIT-III

5. a) Draw the centre tap rectifier circuit and explain its working with the help of input and output waveform.

   b) What is an Ohmic contact? Explain two types of contacts for semiconductor devices. 7+(2+5)=14

6. a) Draw the bridge rectifier circuit and explain its working giving input and output waveform.

   b) The load resistance of a centre-tap full wave rectifier is 500 Ω and the necessary voltage is having forward resistance of 50 Ω

   Calculate-

   i) Peak, average and rms values of current

   ii) Ripple factor

   iii) Efficiency of the rectifier 8+6=14

UNIT-IV

7. a) Define α, β and γ of a transistor and derive the relationship between them.

   b) In CE configuration collector supply voltage V_{cc}= 10v, load resistance R_c is 8 KΩ. Draw dc load line. Determine the operating point Q for zero signal if base current is 15 μA and β is 40. (3+7)+4=14

8. a) Explain the need of biasing a transistor.

   b) Draw the circuit diagram of an NPN junction transistor CE configuration and describe the static input and output characteristics. Also define active, saturation and cut-off regions, and saturation resistance of a CE transistor. 4+(5+5)=14

UNIT-V

9. a) Describe channel length modulation in MOSFET.

   b) Briefly explain the temperature effect in MOSFET.