Registration No :

Total Number of Pages : 02

B.Tech
REC4D001 / REI4G002

4th Semester Regular/Back Examination: 2022-23
SUBJECT: Semiconductor Devices
BRANCH(S): AEIE,EIE ECE, ETC
Time : 3 Hour
Max Marks : 100
Q.Code : M108
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Why Fermi level is so important in solid-state physics?
b) What is the non-equlibrium properties of carriers?
c) Explain density of states function.
d) What do you mean by freeze out condition?
e) What is the depletion layer of a pn junction?
f) What is pinch-off voltage?
g) What is the relationship between collector current and base current in BJT?
h) What are the limitations of BJTs in high-frequency applications?
i) How is tunneling used in various electronic devices?
j) In which way n-type BJT is different from p-type BJT?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) Compare and contrast the energy band diagrams of conductors, semiconductors and insulators.
b) Define Fermi level. How is the Fermi distribution function used to calculate the electron and hole concentration in semiconductor?
c) What are the different types of carrier scattering mechanisms in semiconductors?
d) Write the expression for drift and diffusion current densities.
e) What is a PN Junction? Explain the biasing concept in PN Junction.
f) Draw and explain the working principle of FET.
g) Discuss the breakdown mechanism in BJT.
h) Write the Eber's-Moll equations for a BJT. Sketch the equivalent circuit which satisfies these equations.
i) Compare between Schottky barrier diode and PN-junction diode.
j) List frequency limitation factors in MOSFET. Obtain relation for cutoff frequency in ideal case.
k) What is meant by probability density function? How it is useful in semiconductors?
l) Write down the difference between Tunneling breakdown and avalanche breakdown.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **(a)** Explain Energy band theory in detail. **(8)**

(b) Why pure crystal is required as a substrate in semiconductor device? List various methods used in growth of semiconductor material. Explain any one in detail. **(8)**

Q4 **(a)** Explain the concept of thermally activated carriers in doped semiconductors at different temperatures. **(8)**

(b) How are the diffusion coefficient and mobility related in the Einstein relationship? **(8)**

Q5 **(a)** Describe operation of reverse biased PN junction diode. **(8)**

(b) State importance of equivalent circuit models used in BJT analysis. Explain hybrid-pi model for this device. **(8)**

Q6 **(a)** Describe the charge flow mechanism in a forward biased Schottky barrier diode. **(8)**

(b) Derive an expression for flat band voltage and threshold voltage for a MOS device. **(8)**