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EC 131304

Roll No. of candidate | | | | | | | | | | | |

2019

B.Tech. 3rd Semester End-Term Examination

SEMICONDUCTOR AND ELECTRONIC DEVICES

(New Regulation)

(w.e.f 2017 – 2018)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *four* from the rest.

1. Answer the following : (10 × 1 = 10)

   (i) The electrons in the outermost orbit is known as ———— electrons

   (ii) The conductivity of insulator is ———— than conductor.

   (iii) The trans-conductance curve of JFET is ————.

   (iv) In P-type semiconductor the Fermi level shifts towards ———— band.

   (v) Tunnel diode is ———— doped than the normal semiconductor diode.

[Turn over

(vi) Diffusion current density occurs due to

(a) Non uniform doping

(b) Uniform doping

(c) None of the above

(vii) The volt equivalent of temperature V_T is expressed as

(a) $\frac{KT}{q}$

(b) $\frac{q}{KT}$

(c) qKT

(viii) Field effect transistor is a

(a) Current controlled device

(b) Voltage controlled device

(c) None

(ix) At $0°K$ intrinsic semiconductor behaves as

(a) Insulator

(b) Conductor

(c) Metal

(x) In indirect band-gap the maximum energy of a valence band occurs at

(a) Same momentum value as the energy of the conduction band

(b) Different momentum energy of the conduction band

(c) None of the above

2. (a) Prove the mass action law. (3)

(b) With the help of suitable diagram describe Hall effect. What properties of semiconductor are determined from Hall effect? (5)

(c) Show the Forward bias and reverse bias action of diode diagrammatically. (4)

(d) Plot the volt ampere curve for Ge and Si to the same scale, showing the cut in voltage for each. (3)

3. (a) What is the relationship of band-gap energy of Ge with temperature. Calculate the band-gap energy of Ge at 300°K. (5)

(b) A Si sample A is doped with $10^{18}/cm^3$ of Boron. Another sample B of identical dimension is doped with $10^{18}/cm^3$ of phosphorus. The ratio of the electrons to hole mobility is 3. Calculate the ratio of conductivity of the sample. (3)

(c) Distinguish between drift and diffusion current. (4)

(d) State Einstein's relationship in semiconductor. Also write the expression and explain its significance. (3)

4. Differentiate between $(5 \times 3 = 15)$

(a) Intrinsic and extrinsic semiconductor.

(b) N-type and P-type semiconductor.

(c) Direct and indirect band-gap.

(d) Drift and diffusion current.

(e) Insulator, conductor and semiconductor.

5. (a) What is Fermi Level? Explain how the Fermi Level of semiconductor changes with doping does. (5)

(b) Explain why N-type semiconductor has excess of electrons whereas aP-type semiconductor has excess of holes. (4)

(c) Why is the Fermi Level of N-type semiconductor near the conduction band whereas that of P-type semiconductor is near the valence band? (3)

(d) Find the energy band-gap of Si at 1000°K. (3)

6. (a) What is JFET? Draw its basic structure and explain its working principle. Mention the characteristics of JFET. How is it different from MOSFET. (10)

(b) Explain the Eber's Moll model and write the equation. (5)

7. Write short notes on any THREE of the following $(3 \times 5 = 15)$

(a) Eber's moll model

(b) Tunnel diode

(c) Working of depletion MOSFET

(d) Input and output characteristics of CE configuration

(e) Zener diode as voltage regulator.
