(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0322 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. III) ODD SEMESTER THEORY EXAMINATION 2012-13

FUNDAMENTALS OF ELECTRONIC DEVICES

Time : 3 Hours *Total Marks : 100*

Note : *Attempt **all** questions. All questions carry equal marks. Assume suitable data if not given.*

1. Attempt any **four** parts of the following : **(5×4=20)**

(a) With suitable sketch describe briefly the diamond lattice.

(b) What is Miller Indices ? What is the advantage of taking the reciprocals of the intercepts in determination of Miller Indices of a particular plane ? Explain with example.

(c) Calculate the density of GaAs if the lattice constant of GaAs is 5.65×10^{-8} cm. The atomic weights of Ga and As are 69.7 and 74.9 grams/mole respectively. Also, given Avogadro's Number = 6.02×10^{23} atoms/mole.

(d) What do you mean by effective mass of carriers ? What is the kinetic energy of a hole at the top of the valence bond ?

(e) Define Fermi level and sketch the Fermi function at 0°C. Calculate the probabilities of finding electrons and holes at the energy level of 0.1 eV above and below the Fermi level at temperature 0 K.

(f) Calculate minimum conductivity of Si at 300 K. Derive the expression used, if any.

2. Attempt any **four** parts of the following : **(5×4=20)**

(a) In Si semiconductor it is observed that three quarters of current is carried by holes and the rest part by electrons. What is the ratio of electrons to holes concentration ?

(b) Distinguish between traps and recombination center. Explain with suitable sketch.

(c) What do you mean by photoluminescence ? Explain with suitable sketch, the difference between fluorescents and phosphors.

(d) Define and derive the expression for minority carrier life time.

(e) Define quasi Fermi levels. Also show that for steady state condition the product of electron and hole concentrations is equal to $n_i^2\, e^{(F_n - F_p)/KT}$, where n_i is intrinsic carrier concentration and $(F_n - F_p)$ is the separation of the quasi-Fermi levels.

(f) What is the physical significance of diffusion length ? How is it related with mobility of the carrier ?

3. Attempt any **two** parts of the following : **(10×2=20)**

(a) What is contact potential ? Explain. Derive an expression for it assuming step junction at equilibrium condition.

For Si p-n junction, donor and acceptor impurities at room temperature are 10^{16} cm^{-3} and 3×10^{18} cm^{-3} respectively. Calculate the contact potential and draw an equilibrium band diagram for the junction if intrinsic carrier concentration of Si is 1.5×10^{10} cm^{-3} at room temperature.

(b) Derive an expression for the current-voltage relation in an ideal p-n junction diode.

(c) Assume that an ideal Schottky barrier is formed on n-type Si having 10^{15} As atoms per cm^3. The metal work function is 4.3 eV and Si electron affinity is 4 eV. Draw the equilibrium band diagram with values calculated for appropriate barriers and describe the contact.

4. Attempt any **two** parts of the following : **(10×2=20)**

(a) What are the basic difference between the FET and BJT ? Describe the construction, operation and characteristics of an enhancement type MOSFET.

(b) What are the special features of MESFET ? Explain the working of normally-off MESFETs with its characteristics.

(c) Explain how a Bipolar Junction Transistor can be used as an amplifier. Define the emitter injection efficiency, current transfer ratio and Base-to-Collector current amplification factor.

5. Attempt any **two** parts of the following : **(10×2=20)**

(a) What is meant by IMPATT ? Explain the construction and operation of an IMPATT diode.

(b) Discuss the switching mechanism of the p-n-p-n diode with the help of the two transistor analogy.

(c) What is photodiode ? What are its different types ? Describe the construction of a photodiode with its operation.