

(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)

- 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 ?
- Distinguish between traps and recombination center. Explain with suitable sketch.
- What do you mean by photoluminescence ? Explain with suitable sketch, the difference between fluorescents and phosphors.
- Define and derive the expression for minority carrier life time.
- 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.
- 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)

- 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 $3 \times 10^{18} \text{ cm}^{-3}$ respectively. Calculate the contact potential and draw an equilibrium band diagram for the junction if intrinsic carrier concentration of Si is $1.5 \times 10^{10} \text{ cm}^{-3}$ at room temperature.

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

- 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)

- What are the basic difference between the FET and BJT ? Describe the construction, operation and characteristics of an enhancement type MOSFET.
- What are the special features of MESFET ? Explain the working of normally-off MESFETs with its characteristics.
- 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)

- What is meant by IMPATT ? Explain the construction and operation of an IMPATT diode.
- Discuss the switching mechanism of the p-n-p-n diode with the help of the two transistor analogy.
- What is photodiode ? What are its different types ? Describe the construction of a photodiode with its operation.