(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 2010-11

FUNDAMENTAL OF ELECTRONIC DEVICES

Time : 3 Hours *Total Marks : 100*

Note : Attempt **all** questions. All questions carry equal marks.

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

   (a) With a suitable sketch describe briefly the lattice structure of GaAs.

   (b) What is Miller Indices ? Show the (643) plane and the [643] direction in a cubic crystal lattice.

   (c) Classify semiconductor according to band structure. Explain with examples.

   (d) What do you mean by effective mass of carriers ? How does it depend on energy bands ?

   (e) Explain briefly why the temperature coefficient of the resistivity of a doped semiconductor is negative at low and high temperature but positive at intermediate temperature.

   (f) Calculate the Fermi level position in Si containing 10^{16} Phosphorus atoms/cm^3 at 100 K assuming 50% of the impurities are ionized at this temperature. Also calculate the equilibrium electrons and holes concentrations.

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

(a) What are the direct and indirect recombination ? Derive an expression for minority carrier life time.

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

(c) What is quasi-fermi levels ? Explain.

A Ge sample with 10^{17} Phosphorus atoms/cm^3 is optically excited at 300 K such that gop = 10^{20} EHP/cm^3-sec and $\tau_n = \tau_p = 10$ μsec. What is the separation of the quasi-Fermi levels ? Draw a band diagram showing the result. Given that intrinsic carrier concentration for Ge at room temperature is $2{\cdot}5 \times 10^{13}$ per cm^3.

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

(a) What is diffusion potential ? Assuming equilibrium condition at a step junction, derive an expression for diffusion potential.

(b) What do you mean by minority carrier injection and minority carrier extraction ? Derive an expression for total current through the diode for either forward or reverse bias.

(c) Describe the physical mechanism for p-n junction breakdown. Draw a circuit which uses a breakdown diode to regulate the voltage across a load. Explain its operation.

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

(a) Enumerate the special features of MESFET. Explain its working and state the difference between normally-on and normally-off MESFETs.

(b) What are the advantages and disadvantages of FET over BJT ? Describe the construction and operation of MOSFET with suitable diagram.

(c) Explain how a Bipolar Junction Transistor can be used as a switch. Explain the factor which determine the switching speed of BJT.

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

(a) What is transferred electron effect ? Describe a device based on this effect with suitable diagram in detail. Also draw its characteristics.

(b) What is photo-detector ? Explain the operation of a p-i-n photodetector. What are the suitable material for it ? How can it be made more sensitive to low level intensity of light ?

(c) With a suitable diagram describe the operation and characteristics of a four-layer diode. Explain the various triggering mechanism of this diode.