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

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

B. Tech.

(SEM. III) THEORY EXAMINATION 2011-12

FUNDAMENTALS OF ELECTRONIC DEVICES

Time : 3 Hours *Total Marks : 100*

Note :– (1) Attempt **all** questions. All questions carry equal marks.

(2) Be precise in your answer. No second answer book will be provided.

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

(a) State the fermi Dirac energy distribution function, show the fermi level position in p-type semiconductor at 0, 300 and 400 K.

(b) Explain the various e^- energy bands in solids Based on these bands distinguish between insulator, conductor and semiconductors.

(c) For a semiconductor, $\mu_n = \mu_p = 1000$ cm^2/vsec and $N_c = N_v = 10^{19}$ cm^{-3}. If the conductivity of the intrinsic semiconductor at 300 K is 4×10^{-6} $(\Omega - cm)^{-1}$. What is the conductivity at 600 K ?

(d) Explain the effects of Temperature on doping and mobility.

(e) In a semiconductor at room temperature, the intrinsic carrier concentration and intrinsic resistivity are 1.5×10^{16}/m^3 and 2×10^3 Ωm respectively. It is converted into an extrinsic semiconductor with a doping concentration of 10^{20}/m^3 for the extrinsic semiconductor. Calculate for the extrinsic minority carrier conc, e^- mobility and resistivity of doped semiconductor, minority carrier concentration when temperature is increased to a value at which intrinsic carrier concentration n_i is doubled $\mu_n = \mu_p$.

(f) How many times the conductivity increases because of doping ? Assume total number of atoms in 4.421×10^{21} per cm^3 in Ge $n_i = 2.5 \times 10^{13}$ atoms/cm^3, $\mu_n = 3800$ cm^2/vsec, $\mu_p = 1800$ cm^2/vsec.

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

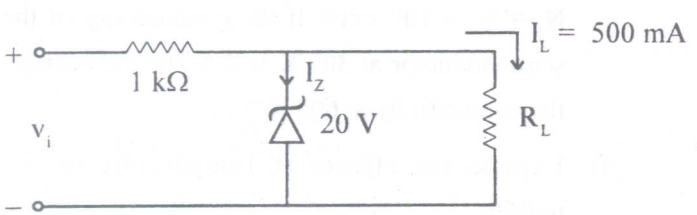
(a) What is luminescence ? Explain excitation and recombination of photoluminescence with trap level for electrons.

(b) What is photoconductivity ? Explain how the photocurrent is proportional to the lifetime and inversely proportional to transit time of carrier.

(c) Draw the spectral response of Si and Ge and relationship between wavelength and Eg (Energy Gap) for Si and Ge at room temperature.

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

(a) For the regulator circuit shown below. Calculate Regulated Voltage, Load Resistance unregulated voltage, P_z, R_z, $I_z = 10\%$ I_L. Also explain Zener and Avalanche Breakdown.



(b) Explain the formation of built in potential across a p-n junction diode without the application of an external bias voltage. How is this built in potential modified by the application of forward and reverse bias voltage that leads to a net current across the diode ?

(c) Write short notes on any **two** of the following :

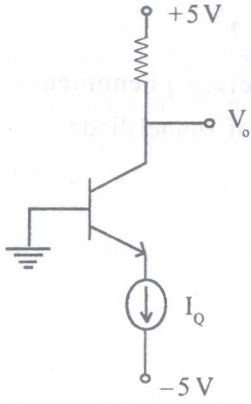
(i) Transition and diffusion capacitance of a junction diode.

(ii) Varactor diode.

(iii) Storage and transition times of a p-n junction diode.

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

(a) Compare CB, CE and CC configurations of a transistor. Prove that $I_C = \beta I_B + (1 + \beta) I_{CO}$. In figure, if $V_{CB} = 0.5$ v, find I_Q :



(b) Explain the construction and working of any **two** :

(i) Depletion type MOSFET

(ii) Enhancement type MOSFET

(iii) Junction Field Effect Transistor (JFET).

(c) Enumerate the special feature of MESFET. Explain its working and discuss difference in its characteristics from the MOSFET.

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

(a) What is an LDR ? Give its basic construction symbol and characteristics. How an LDR can be used as a detector ?

(b) Explain the working principle of Photovoltaic cell. Give its circuit symbol, voltage-current characteristics.

(c) What is a photodetector ? Describe the working of Solar Cell ?

(d) Define light emitting materials. What determines the emission of colour of LED ?

(e) What is the basic difference between GUNN diode and IMPATT diode ?

(f) What is tunneling phenomenon ? Explain the V-I characteristics of Tunnel diode.