Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**

BSCP1207

4th Semester Back Examination 2017-18

PHYSICS OF SEMICONDUCTOR DEVICES

BRANCH : AEIE, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, IEE

Time : 3 Hours

Max Marks : 70

Q.CODE : C996

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

Answer all parts of a question at a place.

Q1. Answer the following questions : **(2 x 10)**

a) What is direct semiconductor? Draw its band structure diagram.

b) Write Fermi-Dirac distribution function?

c) Draw the graph for the position of Fermi level as a function of donor concentration (n-type) and acceptor concentration (p-type).

d) Graphically show the variation of carrier concentration with temperature.

e) Define drift current and drift velocity.

f) Write about built in potential and write its physical significance.

g) What is early voltage?

h) Draw the energy level diagram for forward and reverse biasing of Schottky barrier diode.

i) What do you mean by accumulation of charge?

j) What is effective mass? Write an expression for it.

Q2. a) Explain the formation of energy band in solid with suitable diagram. **(5)**

b) What is band theory of solids? Give the energy band structure of insulators, semiconductors and conductors. **(5)**

Q3. a) Derive equation for concentration of holes, when the semi-conductor is in equilibrium condition. **(5)**

b) Show that in an intrinsic semi-conductor, the Fermi level exists at the mid of the energy gap. **(5)**

Q4. a) Derive an expression for drift current density and diffusion current density, and write the expression for total current density explaining each term associated with it. **(5)**

b) Derive expression for excess minority carrier electron concentration in the base region for an NPN transistor operating in the forward active mode. **(5)**

Q5. a) What is junction breakdown? Discuss different breakdown that is associated with a PN junction. **(6)**

b) Calculate the built in potential in a silicon PN Junction at 300 K with doping concentration of $N_d = 10^{16}/cm^3$ and $N_a = 5x10^{17}/cm^3$. Assume $n_i = 1.5x10^{10}/cm^3$ and kT/e = 0.026 volt. **(4)**

Q6. **a)** Derive the ideal diode equation. **(5)**

b) What are the differences between a Schottky barrier diode and the pn-junction diode? **(5)**

Q7. **a)** What is threshold voltage? Derive expression for threshold voltage of a MOS capacitor with suitable energy band diagram. **(5)**

b) What is MOSFET? Explain the basic operation of the MOSFET. How does the constructional feature of a MOSFET differ from that of a JFET? **(5)**

Q8. **Write short answer on any TWO :** **(5 x 2)**

a) C-V Characteristics of PN junction

b) Eber-moll model

c) Breakdown mechanism in BJT

d) CMOS technology