Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **B.TECH**
BSCP1207

3rd Semester Regular / Back Examination 2015-16
PHYSICS OF SEMICONDUCTOR DEVICES
BRANCH: AEIE,BIOTECH,CSE,EC,EEE,EIE,ELECTRICAL,ETC,IEE,IT

Time: 3 Hours
Max Marks: 70
Q.CODE: T714

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

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

a) An experiment is carried out in semiconductor research laboratory and result revealed that: "**A semiconductor is transparent to a light having wavelength longer than 0.85 μm**". Write the probable name of this semiconductor and also mentioned whether it belongs to direct or indirect band gap semiconductor.

b) Differentiate degenerate semiconductor from non-degenerate semiconductor.

c) What do you mean by dispersion relation?

d) Draw a plot to indicate drift velocity variation in a semiconductor with applied field.

e) Compare the impurity doping concentrations in different regions of bipolar junction transistor.

f) Assume that the motilities of carrier at T=300 K is 925 cm^2/sec. Calculate the carrier diffusion coefficient.

g) Determine the total number of energy states in Silicon between E_c and E_c + KT at T = 300^0K

h) What is meant by latch-up in a CMOS structure

i) What do you mean by space charge width? On what parameters it depend?

j) What is band gap theory??

Q2 **a)** List out the difference between MOSFET, MESFET and MODFET. **(5)**

b) What is meant by the threshold voltage of an MOS structure? Derive an expression for the threshold voltage in terms of the physical parameters **(5)**

Q3 **a)** Derive 'p_0 'equation **(5)**

b) The electron concentration in silicon decreases linearly from 10^{16} cm^{-3} to 10^{15} cm^{-3} over a distance 0.10.cm. The cross sectional area of the sample is 0.05 cm^2. The electron diffusion coefficient is 25 cm^2/sec. Calculate the electron diffusion current. **(5)**

Q4 Derive the expression for minority carrier distribution in base region. And also discuss Gummel number for low level injection. **(10)**

Q5 **a)** Brief about built-in potential in pn- junction including energy band diagram. **(5)**

b) Explain the meaning of freeze out condition, complete and partial ionization **(5)**

Q6 **a)** Elaborate the concept of charge inversion in MOSFET?. Also write appropriate mathematical expression to realize the same. **(5)**

b) A silicon pn junction at T=300 K has doping concentrations $N_d=3\times10^{15}$ cm^{-3} and $N_a=8\times10^{15}$ cm^{-3} and has a cross-sectional area of 5×10^{-5} cm^2. Determine the junction capacitance for V_R= 2V. **(5)**

Q7 **a)** The Schoktty barrier height of a silicon is 0.59 V and the cross-sectional area is $A=10^{-4}$ cm^2 at T=300 K. calculate (a) the ideal reverse saturation current (b) the diode current for V=0.30 V. Given effective Richardson constant $A^*=114$ $A/K^2\text{-}cm^2$. **(5)**

b) Derive IV characteristics of SBD. **(5)**

Q8 Write short notes on any two: **(5 x 2)**

a) MOSFET V_t and Body effect

b) Flat band condition

c) Junction breakdown of pn diode

d) Current continuity equation