Printed pages: 2 **Sub Code: EEC-301**

Paper Id:3021 **Roll No.** | | | | | | | | | | |

B.Tech.
(SEM III) THEORY EXAMINATION 2017-18
Fundamentals of Electronic Devices

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a) Define Depletion Capacitance?
b) In a simple cubic lattice find the ratio of intercepts on the three axes by (1, 3, 2) Plane?
c) The Minority carrier life time in p type material is 10^{-7}s. The mobility of electron in silicon is 0.15 $m^2V^2s^{-1}$ at 300K. What is the diffusion length?
d) What type of semiconductor material is suitable for luminescence effect?
e) Find the relationship among α, β and γ?
f) A JFET has drain current of 5 mA. If I_{DSS} =10 mA and $V_{GS\ off}$ = -6V find the value of V_{GS} and V_P?
g) Why is it not possible to construct a germanium P-N-P-N switching diode?
h) Why SCR can't be used as a bidirectional switch?
i) What is Avalanche multiplication?
j) Define Quasi Fermi level?

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a) In an N-type silicon sample, the Fermi Level is 0.3 eV below the conduction band edge. Find the electron and hole concentration in the sample at room temperature. For Si, E_g=1.1 eV $n_i = 1.5x10^{10}\ cm^{-3}$

b) Describe the solar cell? Why must a solar cell be operated in the fourth quadrant of the junction V-I characteristic?

c) Find the reverse saturation current density in Si junction with following data: $N_d=10^{21}\ m^{-3}$, $N_a=10^{22}\ m^{-3}$, $D_n=3.4x10^{-3}\ m^2s^{-1}$,$D_p=1.2x10^{-3}\ m^2s^{-1}$ $L_n=7.1x10^{-4}$ m , $L_p=7.1x10^{-4}$ m $n_i=1.5x10^{16}\ m^{-3}$ &
Explain the operation & characteristic of JFET?

d) What is meant by unit cell and lattice constant? Show that for a cubic lattice, the lattice constant a is given by $a = \left(\frac{nM}{\rho N}\right)^{1/3}$ symbols has usual meaning.

e) Explain the construction & characteristic of P-channel Depletion MOSFET? & explain the different transistor Configuration?

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

a) Discuss diffusion and drift of carriers? Derive the Einstein's relation?

b)Explain the Mass Action Law? Show that electron concentration in the semiconductor can be given by

$$n_o = \frac{N_d^+ - N_a^-}{2} + \sqrt{\left(\frac{N_d^+ - N_a^-}{2}\right)^2 + n_i^2}$$

4. Attempt any *one* part of the following: 10 x 1 = 10

a) What is meant by carrier lifetime? Derive the continuity equation?

b) What is the Hall Effect and its application? Derive the relation $\theta_H = \tan^{-1}\theta(\mu B)$

5. Attempt any *one* part of the following: 10 x 1 = 10

a) Describe briefly the Ebers-Moll Model of a Transistor? The reverse saturation current in NPN in CB configuration is 15.5 μA. for an emitter current of 4 mA, collector current is 2.47 mA. Find the current gain & base current?

b**)** Draw the circuit diagram of a CE amplifier in BJT? Explain the mechanism of amplification?

6. Attempt any *one* part of the following: 10 x 1 = 10

a) What are the different modes of operation in MOSFET? Draw the static drain characteristic and transfer characteristic curves for N-channel enhancement type MOSFET?

b) Sketch and explain the construction and operation of a MISFET? Discuss its characteristic?

7. Attempt any *one* part of the following: 10 x 1 = 10

a) Explain the V-I characteristic of a photodiode? Why is GaAs an important semiconductor for the fabrication of the Gunn diode?

b) Explain the working principle of LED? What type of material is suitable for LED?