Printed Pages: 02 **Sub Code: EEC013**
Paper Id: | 1 | 3 | 1 | 6 | 1 | 3 | **Roll No.**

B. TECH.
THEORY EXAMINATION 2017-18
ADVANCE SEMICONDUCTOR DEVICES

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

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

SECTION A

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

a. Draw the energy level diagram of a PN junction.
b. Define mobility.
c. Give the expression for minority carrier life time.
d. What is contact potential?
e. Define depletion width.
f. The Si energy gap changes monotonically with temperature. What is the basic concept behind this?
g. Make the energy band diagram of a metal and semiconductor junction at equilibrium. Consider Al metal having a large work function and n-type semiconductor.
h. What is meant by IMPATT diode?
i. State three major differences between photodiode and solar cell.
j. Explain charge coupled device (CCD).

SECTION B

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

a. Explain Zener and Avalanche Breakdown in p-n Junction.
b. What is meant by TRAPATT? Describe briefly the principle of operation of TRAPATT diode.
c. Explain Carrier life time, electron hole pair, recombination, diffusion length.
d. Explain construction and working of Backward Diode and The Schottkey Barrier Diode.
e. Explain the principle of operation, storage and transfer of charge in basic charge coupled device (CCD).

SECTION C

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

a. Write short notes on (i) Avalanche diode (ii) Fermi level
b. Give construction, working and application of solar cell.

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

a. Discuss operation, applications and symbol of Zener and Tunnel diode.
b. Explain Basic Structures and the Operating Principle with I-V Characteristics of MOSFET.

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

a. In a Si sample 10^{13} EHP/cm3 are created optically every microsecond with n0=10^{14}/cm3 and tn=2μsec and tp=1μsec. find steady state excess electron and hole concentrations and also estimate separation between quasi Fermi levels by showing in band diagrams.

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

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

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

b. Draw a schematic diagram of TRAPATT diode and discuss its working principle. Calculate the avalanche-zone velocity for a TRAPATT diode having the acceptor doping concentration in the p-region Na = $10^{15}/cm^3$ and current density J = 8 kA/cm^2.

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

a. Write short notes on
   - i. Light Emitting Diodes
   - ii. Semiconductor Lasers.

b. Derive the expression for Conductivity and Mobility and also the expression for Diffusion of carriers in semiconductors.