



Name :
 Roll No. :
 Invigilator's Signature :

CS/B.Tech (ECE-OLD)/SEM-3/EC-301/2012-13

2012

SOLID STATE DEVICE

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
 as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :
 $10 \times 1 = 10$

- i) Which type of semiconductor is mostly used for forming transistor
 - a) Si
 - b) Ge
 - c) Inp
 - d) GaAs.
- ii) Which type of capacitance is prominent in reversed bias
 - a) diffusion
 - b) depletion
 - c) none of these
 - d) both of these.
- iii) Which one of the following provides fastest switching
 - a) BJT
 - b) MOSFET
 - c) JFET
 - d) Diode.

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[Turn over

CS/B.Tech (ECE-OLD)/SEM-3/EC-301/2012-13



- iv) Which time is larger
- forward recovery time
 - reverse recovery time
 - vary time to time
 - both are same.
- v) Which current dominates when a pn junction is forward biased
- drift current
 - displacement current
 - diffusion current
 - none of these.
- vi) Input impedance is highest in which
- BJT
 - JFET
 - MOSFET
 - Diode.
- vii) At '0' K The probability of getting electron with energy $E = E_F$ is
- $\frac{1}{2}$
 - $\frac{1}{4}$
 - 0
 - 1.
- Where E_F is the Fermi level energy band.
- viii) If temperature increasing zener break down voltage
- increasing
 - decreasing
 - independent of temperature
 - may increase or decrease.
- ix) Whose mobility is higher
- electron
 - hole
 - both have the same
 - sometime electron some time hole.

CS/B.Tech (ECE-OLD)/SEM-3/EC-301/2012-13



- x) The Varactor Diode is used in which bias
- forward
 - reverse
 - both of these
 - sometime forward sometime reverse
- xi) For an impure semiconductor electron concentration is $4.5 \times 10^{12} / \text{cm}^3$ & hole concentration $4 \times 10^7 / \text{cm}^3$, then position of Fermi level in equilibrium is
- at intrinsic level
 - inside valance band
 - close to conduction band
 - close to valance band.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

- State the basic steps of monolithic IC fabrication. What is photolithography and how it is done in IC fabrication.
- Write short notes on solar cell.
- Briefly explain the working principle of IMPATT Diode.
- Explain rectifying contact and ohmic contact in the light of Schottky Diode
- Draw and explain the static characteristics of a JFET.

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3

[Turn over

CS/B.Tech (ECE-OLD)/SEM-3/EC-301/2012-13

**GROUP – C****(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 15 = 45$

7. Derive the expression for depletion region width in a pn junction diode. Is contact potential is measurable using voltmeter ? What are the differences between zener breakdown and avalanche breakdown ? $10 + 2 + 3$
8. Draw and explain the V-I characteristics of a tunnel diode. Point out the negative differential resistance. Which semiconductors are mostly used for forming tunnel diode ? What is the main condition for constructing tunnel diode ? Mention any two applications of tunnel diode. What do you mean by indirect semi-conductor. $8 + 2 + 1 + 1 + 2 + 1$
9. Draw the output characteristics of a CE mode npn transistor. Why npn transistor is more used than pnp transistor. Write out two major applications of transistor. Is $I_C = \beta I_B$ is true for all three regions, if not then it is true for which region ? $10 + 1 + 2 + 2$
10. Derive the expression for pinch-off voltage in JFET. Explain how channel is formed and current conduction takes place in an Enhancement MOSFET. Define threshold voltage and flat band voltage of MOSFET $6 + 6 + 3$