



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.



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



- x) The Varactor Diode is used in which bias
- a) forward
 - b) reverse
 - c) both of these
 - d) 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
- a) at intrinsic level
 - b) inside valance band
 - c) close to conduction band
 - d) close to valance band.

GROUP – B

(Short Answer Type Questions)

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

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



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 $6 + 6 + 3$