Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech(OLD)/SEM-1/EC-101/2011-12
2011
BASIC ELECTRONICS

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)   How many valence electrons does a silicon atom have ?

   a)   0   b)   1

   c)   2   d)   4.

   ii)   Silicon atoms combine into an orderly pattern called a

   a)   covalent bond   b)   crystal

   c)   semconductor   d)   valence orbit.

   iii) The merging of a free electron and a hole is called

   a)   covalent bonding   b)   lifetime
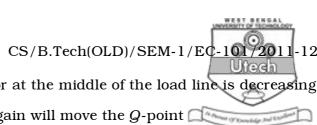
   c)   recombination   d)   thermal energy.

1252-(O)   [Turn over

iv) When the reverse voltage decreases from 10 to 5 V, the depletion layer

a)   becomes smaller   b)   becomes larger

c)   is unaffected   d)   breaks down.

v) What is the peak load voltage in a full-wave rectifier if the secondary voltage is 20 V rms ?

a)   0 V   b)   0.7 V

c)   14.1 V   d)   28.3 V.

vi) A circuit that removes positive or negative part of a waveform is called a

a)   clamper   b)   clipper

c)   diode clamp   d)   limiter.

vii) In an *npn* transistor, the majority carriers in the emitter are

a)   free electrons   b)   holes

c)   none of these   d)   both of these.

viii) If the current gain is 100 and the collector current is 10 mA, the base current is

a)   10 μA   b)   100 μA

c)   1A   d)   10A.

ix) If a transistor at the middle of the load line is decreasing the current gain will move the Q-point

    a)   down   b)   up

    c)   nowhere   d)   of the load line.

x) The output voltage of a CE amplifier is

    a)   amplified

    b)   inverted

    c)   180° out of phase with the input

    d)   all of these.

xi) The transconductance increases when the drain current approaches

    a)   0   b) $I_{D(sat)}$

    c) I_{DSS} d) I_S .

xii) A D-MOSFET can operate in the

    a)   depletion mode only

    b)   enhancement mode only

    c)   depletion mode or enhancement mode

    d)   low impedance mode.

xiii) The trigger voltage of a SCR is closest to

    a)   0 V

    b)   0.7 V

    c)   4 V

    d)   break over voltage.

xiv) The closed loop voltage gain of an inverting amplifier equals to

    a)   the ratio of the input resistance to the feedback resistance

    b)   the open loop voltage gain

    c)   the feedback resistance divided by the input resistance

    d)   the input resistance.

xv) A four layer diode sometimes is called a

    a)   unijunction transistor

    b)   diac
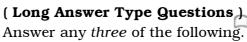
    c)   *pnpn* diode

    d)   switch.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. State the continuity equation. What are the differences between drift and diffusion ?

3. Derive the current equation $I_C = \beta I_B + (\beta + 1) I_{CBO}$ for the transistor.

4. Draw the characteristics of depletion type MOSFET and explain it.

5. What is input offfset current for OPAMP ? What is the advantage and disadvantage of integrated circuit ?

6. How can you measure the frequency of a signal with the hlep of CRO ? What will be the shape of the Lissajous figures, when the phase difference between two signals is

    i)   0 deg

    ii)   90 deg

    iii) 180 deg ?

7. How does the barrier field form in a *p-n* junction ? Is it possible to measure this with the help of a voltmeter ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. Draw the band diagram of *P-N* junction. Differentiate between insulator and semiconductor. Compute the conductivity of a silicon semiconductor which is doped with acceptor impurity to a density of 10^{22} atoms/m^3. Given that $n_i = 1 \cdot 4 \propto 10^{16}$ /m^3, $\mu_n = 0 \cdot 145$ m^2/V-s and

   $\mu_p = 0 \cdot 05$ m^2/V-s. Why there is a reverse saturation current in *P-N* junction ? Why is bridge rectifier more preferable than centre tap fullwave rectifier ? What is the difference between avalanche breakdown and zener breakdown ?

9. Find the expression for current gain with source impedance and input resistance and output resistance for CE amplifier in terms of h-parameter. The CB *h*-parameters of a transistor are $h_{ib} = 30\Omega$, $h_{rb} = 4 \propto 10^{-4}$, $h_{fb} = -0.99$ and $h_{ob} = 0.9$ $\propto 10^{-6}$ S for a suitable operating point. The amplifier is used in the CB mode with a load resistance of

   6 kΩ . Calculate currrent gain and input resistance. Derive the expression for stability factor for collector to base bias.

10. Find the expression of voltage gain for common drain FET amplifier. What is the main difference between depletion type MOSFET and enhancement MOSFET ? As is changed from – 1V to – 1.5V keeping V_{DS} constant I_D of the FET drops from 7 mA to 5 mA. What is the transconductance of the FET ? If the *ac* drain resistance is 200 kΩ, find also the amplification factor of the FET. Why is FET called unipolar device ? Give the simplified model of JFET in terms of μ and r_0 .

11. What is the effect of negative feedback on noise voltage, input impedance ? Draw the block diagram of a negative feedback amplifier. The change in gain of an amplifier without feedback is ± 10%. Find the % change in gain when 20 dB negative feedback is introduced. If the gain of the internal amplifier is 1000, find the feedback ratio and the overall gain of the feedback amplifier. Describe the use of OP-AMP as a differentiator. What is the use of inverting amplifier ?

12. Write short notes on any *three* of the following :   3 × 5

    a)   Clipper circuit

    b)   Hybrid parameters of transistor and their meaning

    c)   UJT

    d)   Application of CRO.

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