Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS / B.TECH (OLD) / SEM-2 / EC-201 / 2011

2011

BASIC ELECTRONICS ENGINEERING

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) β and α of a BJT are related as

a) $\alpha = \dfrac{\beta + 1}{\beta}$ b) $\beta = \dfrac{\alpha}{1 - \alpha}$

c) $\beta = \dfrac{\alpha}{\alpha + 1}$ d) $\alpha = \dfrac{\beta}{\beta - 1}$.

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ii) Avalanche breakdown occurs due to

    a) high electric field at a thin p-n junction

    b) high voltage at a wide p-n junction

    c) low electric field at a thin p-n junction

    d) low voltage at a wide p-n junction.

iii) The depletion layer width of a p-n diode is about

    a) 0·5 cm   b) 0·5 μm

    c) 0·5 nm   d) none of these.

iv) The mass-action law shows that

    a) $np = n_i^2$ b) $np = n_i / 2$

    c) $np = n_i$ d) none of these.

v) Transistor having high impedance and low output impedance is in

    a) CE mode   b) CC mode

    c) CB mode   d) none of these.

vi) The density of majority carriers in a p-type semiconductor depends on the

    a) donor impurity atom concentration

    b) doping technique

    c) intrinsic atom concentration

    d) acceptor impurity atom concentration.

vii) Forbidden gap energy for Ge is

a) 1·20 eV

b) ·785 eV

c) 2·12 eV

d) 1·21 eV.

viii) Value of ripple factor in a half wave rectifier is

a) 1·21

b) 1·31

c) 0·84

d) 1·11.

ix) 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.

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

a) clamper

b) clipper

c) diode clamp

d) limiter.

xi) In non-inverting amplifier circuit if input & feedback resistances are 1 kΩ & 2 kΩ respectively and input voltage is 3 volt, then the output voltage of Op-Amp is

a) − 6 volt

b) + 6 volt

c) − 9 volt

d) + 9 volt.

xii) The transconductance increases when the drain current approaches to

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

    c) I_{DSS} d) I_S.

xiii) In Barkhausen criterion, phase of $A\beta$ is

    a)   0°   b)   multiple of 180°

    c)   0° or multiple of 180°   d)   0° or multiple of 360°.

xiv) The trigger voltage of an SCR is closest to

    a)   0 V   b)   0·7 V

    c)   4 V   d)   break over voltage.

xv) The closed loop voltage gain of an inverting amplifier equals

    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.

GROUP – B

(Short Answer Type Questions)

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

2. What is meant by biasing of amplifier ? Why do you require it ?

3. Give the comparison between the avalanche and Zener breakdown.

4. Explain the fixed biasing of the transistor.

   A centre tapped transformer has 220 V primary winding rated at 6-0-6 volts. This transformer is used in the F.W. rectifier circuit with a load resistance of 100 ohm. What is the d.c output voltage and the r.m.s. voltage developed across the diode ? Assume the diodes and the transformer to be ideal.

5. Find the relation between the common base d.c. current gain and common emitter current gain. 2

   The measured collector and base currents of certain transistor are $I_C = 5 \cdot 202\ \text{mA}$, $I_B = 50\ \mu\text{A}$ and $I_{CBO} = 2\ \mu\text{A}$. Calculate the value of α_{dc} and β_{dc} and I_E. 3

6. Find out the desensitivity factor for a negative feedback amplifier.

   The open loop gain of an amplifier is 80 and it gives an output distortion voltage of 0·1 V. If the tolerable output distortion voltage with negative feedback is 0·05 V, find the reverse transmission factor. 3 + 2

7. How does the barrier field form in a *p-n* junction ? Is it possible to measure this with the help of a voltmeter ? 2 + 3

GROUP – C
(Long Answer Type Questions)

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

8. a) Draw the band diagram of *p-n* junction.

   b) Differentiate between insulator and semiconductor.

   c) Compute the conductivity of a silicon semiconductor which is doped with acceptor impurity to a density of 10^{22} atoms/m³. Given that $n_i = 1 \cdot 4 \times 10^{16} / m^3$, $\mu_n = 0 \cdot 145 \, m^2 /V\text{-s}$ and $\mu_p = 0 \cdot 05 \, m^2 /V\text{-s}$.

   d) Why is there a reverse saturation current in *p-n* junction ? 4 + 4 + 5 + 2
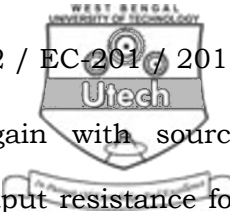
9. a) Find the expression for current gain with source impedance, input resistance and output resistance for CE amplifier in terms of h-parameter.

b) The CB h-parameters of a transistor are $h_{ib} = 30\,\Omega$, $h_{rb} = 4 \times 10^{-4}$, $h_{fb} = -0 \cdot 99$ and $h_{ob} = 0 \cdot 9 \times 10^{-6}\,\text{S}$ for a suitable operating point. The amplifier is used in the CB mode with a load resistance of 6 kΩ. Calculate current gain, voltage gain and input resistance. 9 + 6

10. a) Find the expression of voltage gain for common drain FET amplifier.

b) What is the main difference between depletion type MOSFET and enhancement MOSFET ?

c) As V_{GS} is changed from –1V to –1·5 V keeping V_{DS} constant, I_D of the FET drops from 7mA to 5mA. What is the transconductance of the FET ? If the a.c. drain resistance is 200 kΩ, find also the amplification factor of the FET.

d) Give the simplified model of JFET in terms of μ and r_o.

5 + 3 + 4 + 3

11. a) What is the effect of negative feedback on noise voltage and input impedance ?

    b) 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.

    c) Describe the use of Op-Amp as a differentiator.

    6 + 4 + 5

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

    e) Rectifier.

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