

Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech/SEM-1/EC-101/2009-10

2009

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 × 1 = 10

i) Bandgaps of Silicon and Germanium are

- a) 0.67 eV and 1.1 eV b) 5.89 eV and 4.56 eV
c) 0.87 eV and 6.78 eV d) 0.54 eV and 0.786 eV.

ii) Gain of inverting op-amp is

- a) $-R_f/R_1$
b) $(1 + R_f/R_1)$
c) $(R_f + R_1)/R_f$
d) $-(R_f + R_1)/R_1$.



- iii) In active mode of operation of BJT
- a) emitter-base junction is forward-biased and collector-base junction is reverse-biased
 - b) emitter-base junction is forward-biased and collector-base junction is forward-biased
 - c) emitter-base junction is reverse-biased and collector-junction is forward-biased
 - d) emitter-base junction is reverse-biased and collector-base junction is reverse-biased.
- iv) In CRO, circle is produced as Lissajous figure when the phase difference between x and y -signals is
- a) 90°
 - b) 180°
 - c) 270°
 - d) 0° .
- v) SCR has terminals
- a) 3
 - b) 4
 - c) 2
 - d) 6.
- vi) CMRR =
- a) $\text{Mod } (A_d/A_c)$ [A_d = voltage gain for difference signal; A_c = voltage gain for common mode signal]
 - b) V_2/V_1 [V_1 = non-inverting input terminal signal; V_2 = inverting input terminal signal]
 - c) $A_1 - A_2$ [A_1 = voltage gain when inverting terminal is grounded; A_2 = voltage gain when non-inverting terminal is grounded]
 - d) V_d/V_c [V_d = difference signal; V_c = common-mode signal].



- vii) The diffusion capacitance of a forward-biased $p-n$ junction diode varies
- a) linearly with current
 - b) inversely with current
 - c) as the square of the current
 - d) as the square root of the current.
- viii) When the reverse voltage across $p-n$ junction is gradually decreased, the depletion region inside the diode
- a) does not change in width
 - b) initially increases upto certain width then decreases
 - c) continuously increases in width
 - d) continuously decreases in width.
- ix) Semiconductors have
- a) zero temperature coefficient of resistance
 - b) positive temperature coefficient of resistance
 - c) negative temperature coefficient of resistance
 - d) none of these.
- x) The ripple factor of a power supply is a measure of
- a) its filter efficiency
 - b) its voltage regulation
 - c) diode rating
 - d) purity of power output.



- xi) The maximum efficiency of a full-wave rectifier can be
- a) 37.2%
 - b) 40.6%
 - c) 53.9%
 - d) 81.2%.
- xii) JFET is a
- a) voltage controlled voltage source
 - b) voltage controlled current source
 - c) current controlled voltage source
 - d) current controlled current source.
- xiii) Input and output impedances of a voltage shunt feedback are
- a) $Z_i/(1+A\beta)$ and $Z_o/(1+A\beta)$
 - b) $Z_i(1+A\beta)$ and $Z_o/(1+A\beta)$
 - c) $Z_i/(1+A\beta)$ and $Z_o(1+A\beta)$
 - d) $Z_i(1+A\beta)$ and $Z_o(1+A\beta)$.
- xiv) Unit of diffusion constant for silicon in SI unit is
- a) $\text{m}^2/\text{V.s}$
 - b) m^2/s
 - c) m/s
 - d) V/s .
- xv) Temperature coefficient of resistance for intrinsic semiconductor is
- a) positive
 - b) negative
 - c) infinity
 - d) does not depend on temperature.



GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. Distinguish between Avalanche breakdown and Zener breakdown. Why is Zener diode called reference diode ?
3. What are the advantages and disadvantages of bridge rectifier over full-wave rectifier using two diodes ?
4. Define CMRR of an OPAMP.

When a voltage of $V_1 = 40\mu\text{V}$ is applied to the non-inverting input terminal and a voltage $V_2 = -40\mu\text{V}$ is applied to the inverting input terminal of an OPAMP, an output voltage $V_0 = 100\text{ mV}$ is obtained. But when $V_1 = V_2 = 40\mu\text{V}$, one obtains $V_0 = 4\mu\text{V}$. Calculate the CMRR.

5. What are the basic differences between BJT and FET ? Define pinch of voltage.
6. Derive the expressions for the electrical conductivity of
 - i) an intrinsic semiconductor
 - ii) an N-type semiconductor
 - iii) a P-type semiconductor.



GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following.

3 × 15 = 45

7. a) Explain the term “Drift” related to semiconductors.
- b) What is electrical conductivity ? Derive the expression for electrical conductivity of a semi-conductor.
- c) Show that the total electron current density is equal to the sum of drift and diffusion current density.
- d) Find :
- i) conductivity and
 - ii) resistance of a bar of pure silicon of length 1 cm and cross-sectional area 1 mm^2 at 300 K.
- Given $\mu_n = 0.13 \text{ m}^2/\text{Vs}$, $\mu_p = 0.05 \text{ m}^2/\text{Vs}$,
 $n_i = 1.5 \times 10^{16}/\text{m}^3$.
- 3 + 1 + 3 + 5 + 3
8. a) With regard to full-wave rectification explain the working of a bridge rectifier and compare its PIV with other rectifiers. Give two advantages and disadvantages of the bridge rectifier.

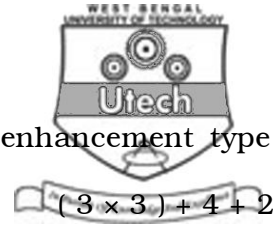


- b) Find out the expression for efficiency, form factor and ripple factor for a half-wave rectifier.
- c) A full-wave rectifier uses a double diode, the forward resistance of each element being 100 ohm. The rectifier supplies current to a load resistance of 1000 ohm. The primary to secondary turns ratio of the centre tapped transformer is 10 : 1. The transformer primary is fed from a supply of 240 V (rms).

Find :

- i) DC load current
 - ii) direct current in each diode
 - iii) the ripple voltage and
 - iv) the efficiency of rectification. (4 + 2) + 3 + 6
9. a) Formulate the expression for voltage gain, current gain and output resistance of a transistor amplifier employing h -parameters.
- b) A transistor amplifier in CE configuration couples a source of internal resistance 1 k Ω to a load of 20 k Ω . Find the input and the output resistance if $h_{ie} = 1$ k Ω , $h_{re} = 2.5 \times 10^{-4}$ k Ω , $h_{fe} = 150$ & $1/h_{oe} = 40$ k Ω .

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- c) Differentiate between depletion and enhancement type MOSFETs.

10. a) Draw the circuit diagram of clamper and explain the working principle of it.

- b) Explain the operation of bridge rectifier with proper circuit diagram.

- c) Evaluate the ripple factor and efficiency of half-wave rectifier.

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

- a) Clipper circuit
- b) Eber-Moll model of transistor
- c) Enhancement and depletion MOSFETs
- d) Hybrid parameters for a transistor.
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