



BRAINWARE UNIVERSITY

Course – BSc(CS)

Introduction to Electrical circuits and Basic Electronics I (BCSG101)

(Semester – 1)

Time allotted: 3 Hours

Full Marks : 70

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Question)

1. Choose the correct alternatives for any *ten* of the following: 1 x10 = 10
- i) The hysteresis curve of a magnetic material is generally studied for
- a) diamagnetic materials b) ferromagnetic materials
c) dielectric material d) paramagnetic materials
- ii) The peak voltage in a 220 V AC source is
- a) 220 V b) about 160 V c) about 310 V d) 440 V
- iii) Two capacitors each having capacitance 'C' and breakdown voltage 'V' are joined in series. The capacitance and breakdown voltage of the combination will be
- a) 2C & 2V b) C & 2V c) 2C & V d) C/2 & 2V
- iv) A Si diode operating at room temperature has the reverse saturation current in the order of
- a) mA b) μ A c) nA d) A
- v) In unbiased p-n junction, total current is zero because
- a) potential barrier does not exist b) no carrier flow across the junction
c) equal & opposite carriers are crossing the junction d) potential barrier becomes infinite

vi) Which of the following quantities do not change when a resistor connected to a battery is heated due to current?

- a) drift velocity b) resistivity c) resistance d) number of free electrons

vii) If ' ω ' is the width of the depletion region, their transition capacitance of a p-n junction is proportional to

- a) $\frac{1}{\omega}$ b) ω c) $\frac{1}{\sqrt{\omega}}$ d) $\sqrt{\omega}$

viii) Three capacitors of capacitance $6\mu\text{F}$ each are available. The minimum and maximum capacitance, which may be obtained are

- a) $6\mu\text{F}$, $18\mu\text{F}$ b) $3\mu\text{F}$, $12\mu\text{F}$ c) $2\mu\text{F}$, $12\mu\text{F}$ d) $2\mu\text{F}$, $18\mu\text{F}$

ix) What is the unit of CR where 'C' is capacitance of capacitor and 'R' is resistance of resistors

- a) Sec b) Ohm c) henry d) none of these

x) The power of AC circuit is maximum when the value of power factor is

- a) $\sqrt{2}$ b) 1 c) 2 d) $\frac{1}{\sqrt{2}}$

xi) In BJT, $I_c = 10 \text{ mA}$ for $I_b = 100 \mu\text{A}$, the approximate value of β is

- a) 100 b) 10 c) 1000 d) 1

xii) The type of a semiconductor n type or p type can be identified by using

- a) Early effect b) tunnel effect c) photo voltaic effect d) Hall effect

xiii) If $\alpha = 0.99$ then β equals

- a) 9.9 b) 0.99 c) 99 d) 199

xiv) To produce significant current in a Si diode, the forward voltage must exceed

- a) 0.3 V b) 0.7V c) 2mV d) 26 mV

Group – B

(Short Answer Type Question)

Answer any *three* of the following.

3 x 5 = 15

2. Explain the action of Zener diode, illustrating both avalanche break down and Zener break down.

5

3. (i) State the principle of action of Light emitting diode (LED). 3
(ii) The band gap of GaAsP is 1.98 eV. Determine the wavelength of electromagnetic radiation emitted upon direct recombination of electrons and holes in the sample (Take $c = 3 \times 10^8$ m/ s and $h = 6.626 \times 10^{-34}$ Js) 2
4. By using Hysteresis loop mention the differences of soft iron and steel. 5
- 5 . Describe DIAC 5
- 6.What is time constant? Find the value of time constant of L-R circuit.
7. State Kirchhof's current and voltage laws and explain those. 5

Group – C

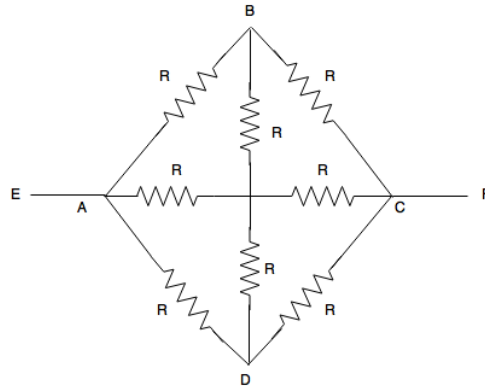
(Long Answer Type Question)

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

8. a) Illustrate differentiation of insulators, metals and semi conductors in the frame work of band theory. 6
b) Deduce the following relation for a semi conductor
 $J = e E (n_p \mu_p + n_e \mu_e)$, where notations have their usual significance 6
c) At 300 K, Ge has intrinsic concentration of $2.5 \times 10^{19} \text{ m}^{-3}$. If electron mobility is $0.38 \text{ m}^2/\text{Vs}$ and hole mobility is $0.18 \text{ m}^2/\text{Vs}$, calculate the electrical conductivity of intrinsic Ge. 3
9. a) Drawing the circuit diagram of a full wave rectifier , using p-n junction diodes, explain its action. Illustrate the use of filter in this context. Define (i) PIV rating and (ii) Ripple factor 5+ 3 +2
b) Describe Photo diode. 5

10. a) Write Faraday's laws of electromagnetic induction. Distinguish between self and mutual inductance. 2+3

(b) What is the equivalent resistance between the points E and F of the given network?
(Where, $R = 3\Omega$) 5



c) Write the effect of different factors on resistance of a resistor. What is the unit of resistivity? 3+2

11. a) Explain different current components of a transistor. 5

b) A n-p-n transistor is operating in CE mode. Calculate V_{CE} if $\beta = 125$. Take $V_{BE} = 0.6V$, V_{BB} (base supply voltage) = 10 V, V_{CC} (collector supply voltage) = 20 V, R_B = (series resistance in base circuit) = 310 k Ω and R_C = (series resistance in collector circuit) = 5 k Ω . 5

c) For a transistor, $I_C = 7mA$, $I_{co} = 25 \mu A$ and $I_B = 0.1mA$, calculate α , β and I_E , where notations carry their usual meanings 5

12. a) In alternating emf fed circuit containing inductance (L) and resistance (R) in series, show that current (I) is lagging behind emf by an angle (θ). 6

b) A coil containing resistance 50.0 Ω and inductance 0.50 henry is connected to an AC source of 110 V, 50.0 cycle/s. Find the impedance and power factor of this coil. 6

c) What is band width of series LCR circuit. Write down the expression of Q factor of circuit in terms of bandwidth and series resonant frequency. 3