Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(N)/SEM-1/ES-101/2012-13

2012

BASIC ELECTRICAL & ELECTRONICS ENGINEERING – I

Time Allotted : 3 Hours *Full Marks* : 70

THIS QUESTION BOOKLET CONSISTS OF 2 PARTS — PART I & PART II.
TO ANSWER THE QUESTIONS USE SEPARATE ANSWER BOOKS FOR SEPARATE PARTS.
DO NOT ANSWER BOTH THE PARTS IN THE SAME ANSWER-BOOK.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

PART – I

(Marks : 35)

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *five* of the following : $5 \times 1 = 5$

   i) Conductance is analogous to

   a) permeance b) flux

   c) reluctance d) inductance.

ii) Energy stored by a capacitor is given by

a) $\frac{1}{2}CV^2$

b) $\frac{1}{2}QV$

c) $\frac{Q^2}{2C}$

iii) In an electrical circuit, if the current lags the voltage by 60°, the circuit nature is

a) R–C b) R–L

c) LC d) none of these.

iv) Kirchhoff's voltage law is used for

a) loop analysis

b) node analysis

c) finding out equivalent resistance

d) none of these.

v) If $E_1 = A \sin \omega t$ and $E_2 = A \sin (\omega t - \theta)$, then

a) E_1 lags E_2

b) E_2 lags E_1

c) E_1 and E_2 are in phase

d) none of these.

vi) The bandwidth of a series resonant *a.c.* circuit is equal to

a) $\frac{R}{(2\pi L)}$ b) $\frac{1}{(RLC)}$

c) $\frac{1}{(2\pi R)}$ d) $\frac{1}{(\omega c)}$.

GROUP – B

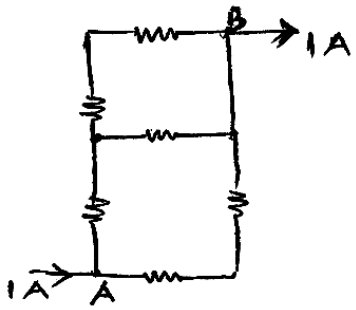
(Short Answer Type Questions)

Answer any *two* of the following. 2 × 5 = 10

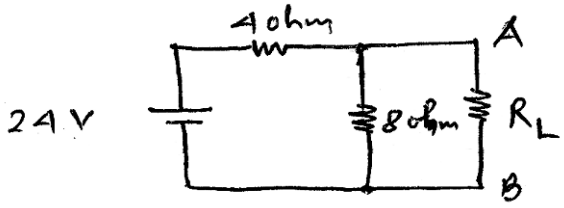
2. Derive an expression for the resonant frequency of a parallel circuit, one branch consisting of a coil of inductance L and a resistance R and the other branch of capacitance C.

3. Establish the equivalence between Thevenin's and Norton's theorems.

4. Find V_{AB} from the circuit if all the resistances are of same value of 1 ohm.



5. Find the value of load resistance (R_L) for which the power source will supply maximum power. Also find the value of the maximum power for the network as shown below :



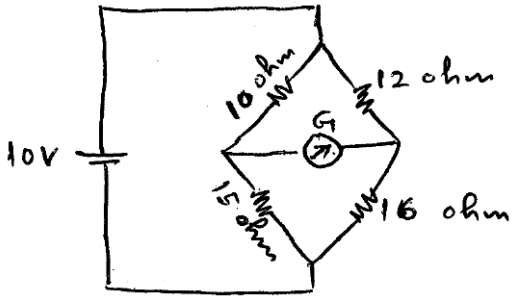
GROUP – C

(Long Answer Type Questions)

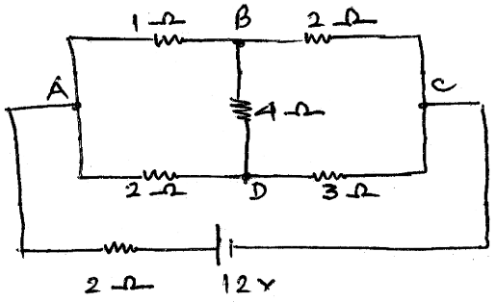
Answer any *two* of the following. 2 × 10 = 20

6. a) Define power factor of an A.C. circuit. State the disadvantages associated with having a load power factor. 4

b) The galvanometer shown in the circuit has a resistance of 5 ohms. Find the current through the galvanometer using Thevenin's theorem.



7. a) Find the current in each branch of the network using Kirchhoff's law. 5



b) Prove that the current in a purely resistive circuit is in phase with applied A.C. voltage and current in a purely capacitive circuit leads applied voltage by 90° and also draw their waveforms. 5

8. a) Define self and mutual inductance. Derive an expression for coefficient of coupling (k) involving self inductances L_1 & L_2 and mutual inductance M. 4

   b) What is meant by hysteresis in a magnetic circuit ? What is the significance of B-H curve ? 3

   c) Find an expression for the energy stored in a magnetic field. 3

9. Explain (a) Star-delta conversion, (b) delta-star conversion with the help of a purely resistive circuit. 5 + 5

USE SEPARATE ANSWER-BOOK TO ANSWER PART-II QUESTIONS.

PART – II

(Marks : 35)

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *five* of the following : $5 \times 1 = 5$

   i) A transistor having a high input impedance and a low output impedance is operating in

   a) *CB* mode b) *CE* mode

   c) *CC* mode d) inverted mode.

ii) α and β of a transistor are related by

a) $\alpha = (\beta + 1)/\beta$ b) $\beta = \alpha/(1 - \alpha)$

c) $\beta = \alpha/(1 + \alpha)$ d) $\alpha = \beta/(1 - \beta)$.

iii) The ripple factor of a half wave rectifier is

a) 0·482 b) 0·41

c) 1·21 d) 1·11

iv) When both junctions are reverse biased, a transistor operates in

a) active b) saturation

c) cut-off d) inverted region.

v) Band gap of Ge is

a) 0·54 eV b) 1·1 eV

c) 0·72 eV d) none of these.

vi) An *n*-type semiconductor is

a) negatively changed

b) positively charged

c) neutral.

GROUP – B

(Short Answer Type Questions)

Answer any *two* of the following. 2 × 5 = 10

2. Explain the operation of a full wave rectifier with centre tapped transformer and draw the D.C. output waveform.

3. What is the role of doping of impurities in pure silicon or germanium ? Draw roughly the position of Fermi level for extrinsic semiconductor and explain.

4. Write a sort note on varactor diode.

5. At 300 K, the intrinsic carrier concentration of silicon is $1{\cdot}5 \times 10^{16}$ m^{-3}. If the electron and hole mobilities are 0·13 and 0·05 $m^2V^{-1}s^{-1}$, calculate the intrinsic resistivity of Si at 300 K.

GROUP – C

(Long Answer Type Questions)

Answer any *two* of the following. 2 × 10 = 20

6. a) Write the differences between Zener breakdown and avalanche breakdown. 3

   b) Explain how a Zener diode can act as a voltage regulator. 4

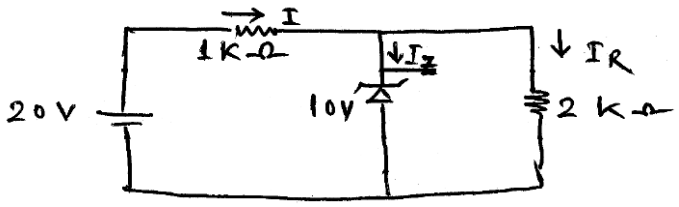
   c) Write a short note on clipper circuit. 3

7. a) Discuss the static characteristics of transistor in *CB* configuration. 5

   b) What do you mean by intrinsic semiconductor ? Explain drift and diffusion current for a semiconductor . 2 + 3

8. a) The reverse saturation current of a NPN transistor operating in CB configuration is 10 μA. For an emitter current of 2·4 mA, the collector current is 2·26 mA. Calculate the current gain and base current. 5

b) Calculate the current I, I_R and I_Z for the following circuit. 5



9. Write short notes on any *two* of the following : 2 × 5

a) Clamper circuit

b) Fermi level

c) Junction capacitance.