Total No. of printed pages = 10

CAI-401/BEC/4th Sem/2017/N

BASIC ELECTRICAL CIRCUITS

Full Marks – 70

Pass Marks – 28

Time – Three hours

The figures in the margin indicate full marks for the questions.

The Question Paper consists of two parts : Part–A and Part–B. Both are compulsory.

PART – A

Marks – 25

All questions are compulsory.

1. Answer the following questions within one sentence each : 1×5=5

   (i) Why parallel connection is used in domestic wiring ?

   (ii) What is the commercial unit of electrical energy ?

   (iii) Should the resistance of an ammeter be low or high ?

[Turn over

(iv) What is the resistance of an electric bulb having rating as 220V, 200W ?

(v) Potential difference across the end of a wire is 0.6V, which carries a current of 8A. Find the resistance of the wire.

2. Choose the correct answer : 1×10=10

(i) Resistivity of a wire depends on

(a) Length

(b) Material

(c) Cross-section area

(d) None of the above.

(ii) Two bulbs marked 200 watt - 250 volts and 100 watt - 250 volts are joined in series to 250 volts supply. Power consumed in circuit is

(a) 33 watt

(b) 67 watt

(c) 100 watt

(d) 300 watt.

(iii) A circuit contains two un-equal resistances in parallel

(a) Current is same in both

(b) Large current flows in larger resistor

(c) Potential difference across each is same

(d) Smaller resistance has smaller conductance.

(iv) Two resistances R1 and R2 give combined resistance of 4.5 ohms when in series and 1 ohm when in parallel. The resistances are

(a) 3 ohms and 6 ohms

(b) 3 ohms and 9 ohms

(c) 1.5 ohms and 3 ohms

(d) 1.5 ohms and 0.5 ohms.

(v) Ohm's law is not applicable to

(a) DC circuits

(b) High currents

(c) Small resistors

(d) Semi-conductors.

(vi) A fuse is always installed in a circuit in

(a) Series

(b) Parallel

(c) Delta connection

(d) None of the above.

(vii) The rating of fuse wire is expressed in terms of

(a) ohms (b) mhos

(c) amperes (d) watts.

(viii) In the color code for resistances black color represents the number

(a) 0 (b) 1

(c) 2 (d) 3.

(ix) Production of heat due to current is related by

(a) Ohm's law (b) Joule's law

(c) Kelvin's law (d) Maxwell's law.

(x) A 1 k, 1 W resistor can safely pass a current of

(A) 30mA (B) 100mA

(C) 150 mA (D) 500 mA.

3. Match the following statements in column A with the correct answer from column B : 1×5=5

Column A	Column B
Electric heater coil	± 5%
Filaments of electric bulbs	± 10%
The tolerance for silver stripe	Tungsten
The tolerance for gold stripe	Conductance
Good conductors have high	Nichrome.

4. Read the following statements. Write TRUE or FALSE against each. 1×5=5

(i) The resistivity of all pure metals increases with increase in temperature.

(ii) Thevenin's theorem replaces a complicated circuit facing a load by an ideal voltage source and series resistor.

(iii) Maximum power is transferred if load resistance is equal to internal resistance of the source.

(iv) The Norton current is sometimes called the shorted-load current.

(v) An ideal voltage source has zero internal resistance.

PART – B

Marks – 45

Answer any *five* 5 questions.

5. (a) Convert the constant voltage source shown in Fig.1 to a constant current source. 4

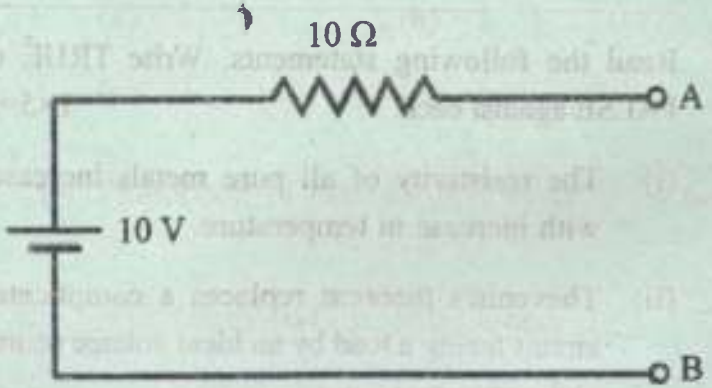

Fig. 1

(b) Calculate the value of load resistance R_L to which Maximum Power can be transferred by the circuit shown in Fig. 2. 5

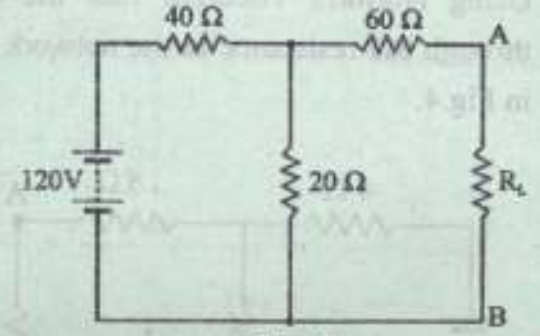

Fig. 2

6. State and prove the "Maximum Power Transfer Theorem" mathematically as applicable to DC networks. 9

7. (a) Using Thevenin's theorem find out the current flowing through the 100Ω resistance in Fig.3 6

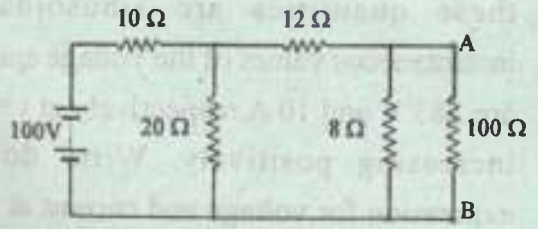

Fig. 3

(b) State and explain Kirchhoff's Laws with suitable examples. 3

8. (a) Using Norton's Theorem find the current through 8Ω resistance in the network shown in Fig.4. 6

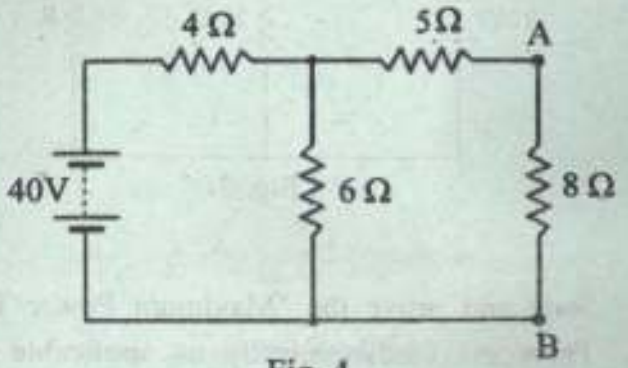

Fig. 4

(b) The maximum values of the alternating voltage and current are 400 V and 20 A respectively in a circuit connected to 50 Hz supply and these quantities are sinusoidal. The instantaneous values of the voltage and current are 283 V and 10 A respectively at t = 0, both increasing positively. Write down the expression for voltage and current at time t. 3

9. (a) Prove that the current in the 50Ω resistance of the network shown in Fig.5 is 0.1A, using any suitable method of your convenience 6

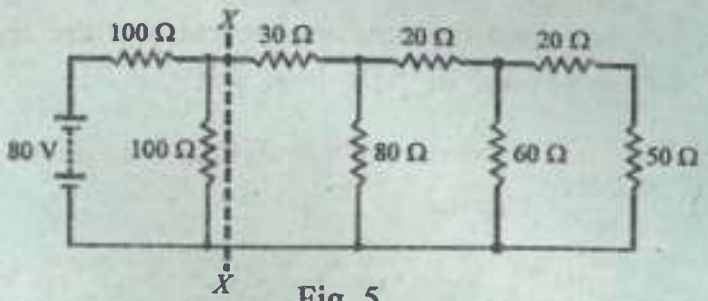

Fig. 5

(b) Find the form-factor of the wave form given in Fig.6. 3

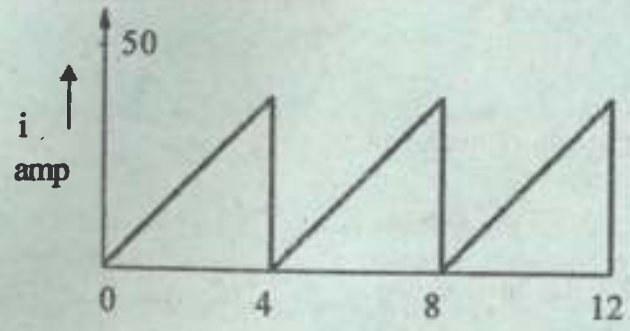

Fig.6

10. (a) A 60-Hz voltage of 115 V (r.m.s.) is impressed on a 100Ω resistance :

(i) Write the time equations for the voltage and the resulting current. Let the zero point of the voltage wave be at t = 0.

(ii) Show the voltage and current on a time diagram.

(iii) Show the voltage and current on a phasor diagram. 6

(b) A 50-μF capacitor is connected across a 230-V, 50-Hz supply. Calculate the reactance offered by the capacitor and the maximum current. 3

11. Write short notes on : 3×3=9

(a) Power factor

(b) Resonance

(c) Form and Peak factor.