Code : 031201

2012

BASIC ELECTRICAL ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The figures in the margin indicate full marks.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer (any *seven*) : 2×7=14

(a) An electric current is the

(i) random movement of electrons in a conductor

(ii) movement of free electrons predominately in one direction

(iii) pressure difference between two poles

(iv) power that causes drift of electrons

(b) Correct form of Ohm's law is

(i) $I = VR$

(ii) $V \propto I$

(iii) $V = IR$

(iv) Both *(i)* and *(iii)*

(c) Resistance of a wire always increases, if

(i) temperature is reduced

(ii) temperature is increased

(iii) number of free electrons available become less

(iv) number of free electrons available become more

(d) A 200 W, 230 V lamp is connected across 115 V supply. The lamp will draw power

(i) slightly more than 50 W

(ii) slightly less than 50 W

(iii) exactly 100 W

(iv) exactly 50 W

(e) Superposition theorem is not applicable for

(i) voltage calculations

(ii) bilateral elements

(iii) power calculations

(iv) passive elements

(f) Maxwell's loop current method of solving electrical networks

(i) uses branch currents

(ii) utilizes Kirchhoff's voltage law

(iii) is confirmed to single-loop circuits

(iv) is a network reduction method

(g) While Thevenizing a circuit between two terminals, V_{TH} is equal to

(i) short-circuit terminal voltage

(ii) open-circuit terminal voltage

(iii) net voltage available in the circuit

(iv) e.m.f. of the battery nearest to the terminals

(h) The unit of flux density is

(i) tesla

(ii) A/mm^2

(iii) N/m^2

(iv) Wb/m

(i) The magnetic field required to reduce the residual magnetization to zero is called

(i) retentivity

(ii) coercivity

(iii) hysteresis

(iv) saturation magnetization

(j) The r.m.s. value of a sine wave is 100 A. Its peak value is

(i) 70·7 A

(ii) 141 A

(iii) 150 A

(iv) 282·8 A

2. (a) Use the node voltage method to determine voltage V in the circuit shown in Fig. 1. Also find the current delivered by the controlled source. 7

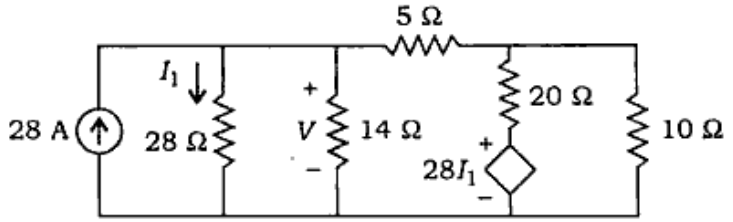

Fig. 1

(b) Use the loop current method to find the current I in the circuit shown in Fig. 2. 7

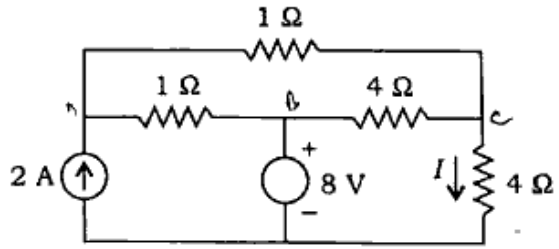

Fig. 2

3. *(a)* Use superposition theorem to find the current in different branches of the circuit shown in Fig. 3. 7

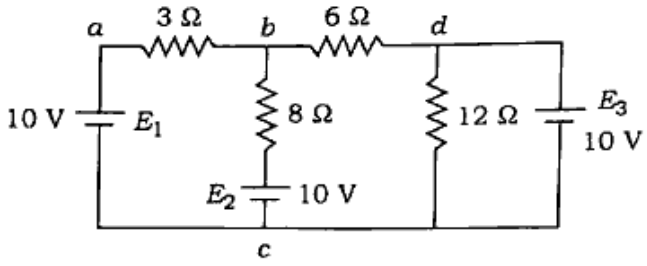

Fig. 3

(b) Use Thevenin's theorem to find the current through the 40 Ω resistance in the circuit shown in Fig. 4. 7

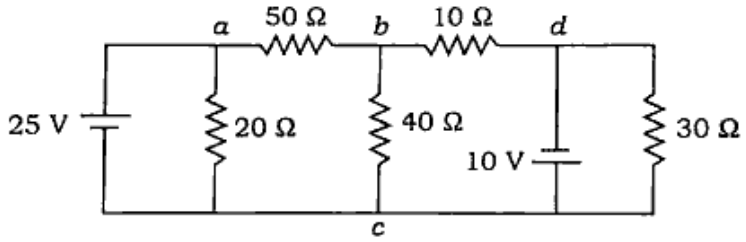

Fig. 4

4. *(a)* Define the following : 8

(i) Form factor

(ii) Peak factor

(iii) Power factor

(iv) Resonance

  (Turn Over)

(b) Determine the r.m.s. and average values of the waveform shown in Fig. 5. 6

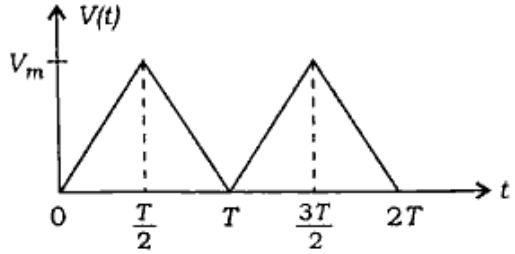

Fig. 5

5. *(a)* State and explain maximum power theorem. 6

(b) Use maximum power transfer theorem to determine R so that maximum power is transferred to it (see Fig. 6). Determine the value of this power. 8

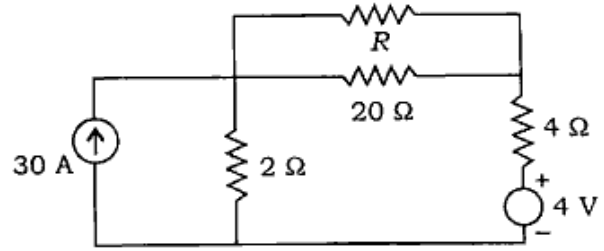

Fig. 6

6. *(a)* A balanced delta-connected load of impedance $(16 + j12)\ \Omega$ per phase is connected to a 3-phase, 400 V supply. Determine the phase current, line current, power factor, power, reactive power and total VA. Also draw the phase diagram. 7

  (Continued)

(b) Explain the following : 7

(i) Balanced and unbalanced systems

(ii) Phase sequence

7. (a) Define apparent, active and reactive power. Derive their formulas. Discuss their significance in a.c. systems. 7

(b) A coil has a resistance to reactance ratio of 170 at 10^6 Hz. Its inductance is 250 μH. A variable capacitor is connected in parallel with the coil. Find the value of C so that resonant frequency is 10^6 Hz. Also find impedance at resonance. 7

8. (a) An iron ring has a mean circumference of 75 cm and a cross-sectional area of 5 cm^2. Its magnetizing coil has 140 turns. Use the following data to find the exciting current for a flux of $6 \cdot 3 \times 10^{-4}$ Wb. Also find μ_r : 8

B (tesla)	0·9	1·1	1·2	1·3
H (A/m)	260	450	600	820

(b) Define reluctance and explain its significance. Which has higher reluctance—an air gap or an iron path? Why? Prove that $B = \mu H$. 6

9. (a) How can the insulation resistance of a cable be measured? Explain the method used. 7

(b) It is desired to convert a moving-coil meter having a full-scale deflection of 2 mA and resistance 20 Ω into a voltmeter of 100 V range. Find the value of series resistance. 7

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