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EI-401/EC&N/4th Sem/2017/N

## ELECTRICAL CIRCUIT AND NETWORK

Full Marks – 70

Time – Three hours

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

PART – A

Marks – 25

Time – One hour

Answer *all* questions.

1. Fill in the blanks with appropriate word or words :

1×10=10

- (a) When a conductor cuts magnetic lines of force an emf is induced in the \_\_\_\_\_.
- (b) Power consumed by a purely inductive circuit is \_\_\_\_\_.
- (c) Admittance is reciprocal of \_\_\_\_\_.

[Turn over

- (d) Number of cycle per second is called \_\_\_\_\_.
- (e) In three phase star connected system line current is equal to \_\_\_\_\_.
- (f) The power equation of AC circuit is \_\_\_\_\_.
- (g) Power factor is the ratio of true power to the \_\_\_\_\_.
- (h) An ideal voltage source has zero internal \_\_\_\_\_.
- (i) At resonant condition of RLC series circuit total reactance becomes equal to \_\_\_\_\_.
- (j) The equation of instantaneous sinusoidal alternating voltage is  $e =$  \_\_\_\_\_ volt.
2. Identify that the following statements are true (T) or false (F) :  $1 \times 10 = 10$
- (a) When a voltage of  $v = V_m \sin$  is applied to a purely resistive circuit the current flowing through it will be  $i = I_m \sin$ .

- (b) According to Kirchhoff's current law algebraic sum of current meeting at a point is positive.
- (c) A lagging power factor implies that voltage is lagging the current.
- (d) Power taken by a resistance of  $20\Omega$  with a flow of 10 amp current is 2K watt.
- (e) Specific resistance of a material is the resistance per unit volume of that material.
- (f) A constant voltage source is the voltage source having very high internal resistance.
- (g) Product of voltage and reactive component of current gives reactive power.
- (h) Time period is the time required to complete one cycle by an alternating quantity.
- (i) A capacitor behaves like an open circuit in DC.
- (j) Thevenin's theorem can be applied only to DC circuit.

3. Each of the following questions comprises two or more than two answers. Select the correct answer. In case you feel that there is more than one correct answer, select the most appropriate one.  $1 \times 5 = 5$

(a) Superposition theorem can be applied only to

- (i) non-linear element
- (ii) linear bilateral network
- (iii) passive circuit

(b) A R-L circuit has  $6\Omega$  resistance and  $8\Omega$  inductive reactance. Its impedance will be

- (i)  $6\Omega$
- (ii)  $10\Omega$
- (iii)  $8\Omega$

(c) Unit of susceptance is

- (i) Ohm
- (ii) Siemens
- (iii) Farad

(d) Commercial unit of electrical energy is

- (i) Watt-sec
- (ii) K Watt
- (iii) K Watt-hour

(e) At resonance in series circuit, current is

- (i) minimum
- (ii) maximum
- (iii) zero.

PART – B

Marks – 45

Time – Two hours

Answer question number 1 and  
any *two* from the rest.

1. (a) State and explain Ohms law. 3
- (b) Write down the characteristics of DC parallel circuit. 3
- (c) Two resistances of  $20\Omega$  and  $30\Omega$  respectively are connected in parallel. The combination of these two further connected in series with a resistance of  $15\Omega$ . If the current through the  $15\Omega$  resistance is 3 ampere find: 9
- (i) current through  $20\Omega$  and  $30\Omega$  respectively
- (ii) voltage across the whole circuit
- (iii) the total power consumed.

2. (a) The following phasors are given below : 6  
 $A = 5 + j5$ ,  $B = 6 + j8$ ,  $C = 4 + j0$ , perform the following indicated operations.

(i)  $AB/C$

(ii)  $BC/A$

(b) A sinusoidal alternating voltage of 50 Hz has an rms value of 200V. Write down the equation for instantaneous value. Find the value .0025 sec after passing through zero and increasing positively. 9

3. (a) Deduce the expression for resonant frequency  $f_n$ , of an RLC series ckt. 6

(b) Find the value of current shared by each of the following impedance connected in parallel, if the total current supplied is 10 ampere.

$$Z_1 = (3 - j6)\Omega ;$$

$$Z_2 = (8 + j4)\Omega \text{ and}$$

$$Z_3 = (4 + j5)\Omega \quad 9$$

4. (a) State and explain Kirchhoff's laws. 5
- (b) A battery having an emf of 110 volt and internal resistance of  $0.2\Omega$  is connected in parallel with another battery with emf of 100 volt and internal resistance of  $0.25\Omega$ . This combination is connected across 220 volt supply with a series resistance of  $5\Omega$ . Calculate the magnitude and direction of current in each battery and total current taken from the supply. Use Kirchhoff's law. 10
5. (a) Explain with proper diagram how a circuit can be Thavenizd. 7
- (b) State and explain Superposition theorem with a simple example. 8
6. (a) For three phase star and delta connected system, write down the relationship between
- (i) line current and phase current
- (ii) line voltage and phase voltage. 6

(b) A coil having a resistance of  $100\Omega$  and inductance  $100$  Henry is connected in series with a  $100\mu$  Farad capacitor. The circuit is connected through a  $10$  volt variable frequency source. Calculate –

(i) the resonant frequency

(ii) current at resonance

(iii) voltage across  $L$  and  $C$  at resonance.

$$3 \times 3 = 9$$

7. Write short notes on any *three* :  $5 \times 3 = 15$

(i) Norton's theorem.

(ii) Maximum power transfer theorem.

(iii) RMS value of alternating current.

(iv) Resonance in RLC parallel circuit.

(vii) Faraday's law of electromagnetic induction.