Total No. of printed pages = 8

END SEMESTER EXAMINATION – 2019

Semester : 4th (Old)

Subject Code : EI-401

ELECTRICAL CIRCUITS AND NETWORKS

Full Marks – 70

Time – Three hours

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

Instructions :

1. *All* questions of PART–A are compulsory.
2. Answer any *five* questions from PART–B.

PART – A

Marks – 25

1 Fill in the blanks : 1×10=10

(a) Ideal voltage source has_____ internal resistance.

(b) The most commonly used polyphase system is _____ system.

[Turn over

(c) In star connection, phase voltage is equal to _____ .

(d) The frequency of AC supply in India is _____.

(e) The power equation of a R-L-C series circuit is _____ .

(f) Admittance is equal to the reciprocal of _____.

(g) In purely capacitive circuit, the power absorbed is equal to _____ .

(h) Under resonance condition, in R-L-C series circuit, inductive reactance is equal to _____.

(i) When voltage applied to a purely inductive circuit is v = Vm sin ωt, the current flowing through it is i = _____.

(j) Superposition theorem can be applied only in a circuit containing more than one _____ .

2 Write true or false : 1×10=10

(a) The reciprocal of resistivity of a material is called its conductivity.

(b) One ampere means the flow of one coulomb each second.

(c) The lower the resistivity, greater the resistance.

(d) Voltage applied across a circuit, acts as a force.

(e) Specific resistance is measured in Ω/m^3 .

(f) Bandwidth is defined as the range of frequency within which the power delivered to R is greater than half the power at resonance.

(g) Any practical voltage source can be converted in to a practical current source and vice-versa.

(h) The formula used to express true power in a balanced 3-ph circuit is $3V_pI_p\cos\Phi$.

(i) Constant voltage source is active and bilateral.

(j) An ideal current source has zero internal resistance.

3. Choose the correct answers : 1×5=5

(a) The Q-factor of a circuit is defined as

(i) $\frac{\text{Reactivepower}}{\text{Resistivepower}}$ (ii) $\frac{1}{R}\sqrt{\frac{L}{C}}$

(iii) $\frac{2\pi fL}{R}$ (iv) All of these

(b) Current flowing in a series circuit having four equal resistance is 1-ampere, what is the magnitude of the current if the four resistances are connected in parallel ?

(i) 0.25I (ii) I

(iii) 4I (iv) 8I

(c) In a network, if the number of nodes is **n** and the number of branches is **b**, the number of independent mesh equations required to solve the network is

(i) $b - n + 1$ (ii) $b + n + 1$

(iii) $b + n - 1$ (iv) $b - n - 1$

(d) Thevenin's theorem can be applied to network containing

(i) passive elements only

(ii) active elements

(iii) linear element only

(iv) All of the above

(e) When maximum power transfer takes place, the efficiency of power transfer of the circuit is

(i) 100% (ii) 75%

(iii) 50% (iv) 25%

PART – B

Marks – 45

4 (a) Express the polar form of voltage $V = 50 \angle 36.87^{\circ}V$ in trigonometrical and rectangular forms. 4

(b) An R-L-C circuit consists of resistance of 1KΩ, an inductance of 0.1H and a capacitance of 10μμF. If a voltage of 100V is applied across the combination, find

(i) the resonant frequency .

(ii) Q-factor of the circuit. 5

5 (a) State Kirchhoff's laws, Thevenin's theorem and Superposition theorem. 4

(b) Find the value of load resistance R_L in Fig. I for transfer of maximum power. Determine also the maximum power. 5

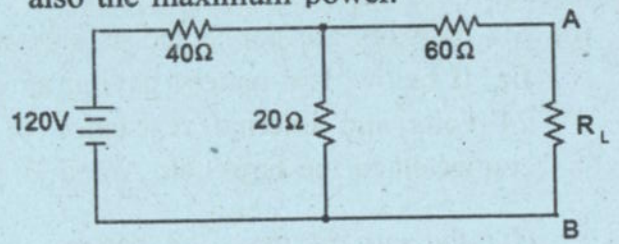

Fig. I

6. An impedance of $(2 + j6)\ \Omega$ is connected in series with two impedances of $(10 + j4)\ \Omega$ and $(12 - j8)\ \Omega$ which are in parallel. Calculate the supply current and power factor if the circuit is connected to 200 volts. 9

7. (a) Write down the relationship between :

   (i) the line voltage and phase voltage of a 3-phase balanced star and delta connected system.

   (ii) the line current and phase current. 4

   (b) Show that in both 3-phase star and 3-phase delta connected system 5

   $P = \sqrt{3}.V_L.I_L\cos\Phi$

8. (a) Define R.M.S value, Form factor and Peak factor of an alternating quantity. 3

   (b) Six resistors are connected as shown in the fig. II below. If a battery having an e.m.f of 24 volts and internal resistance of 1Ω is connected to the terminals A and B, find :

   (i) the current from the battery

   (ii) p.d.across 8Ω and 4Ω resistors

   (iii) the current taken from the battery if a conductor of negligible resistance is connected in parallel with 8Ω resistor. 6

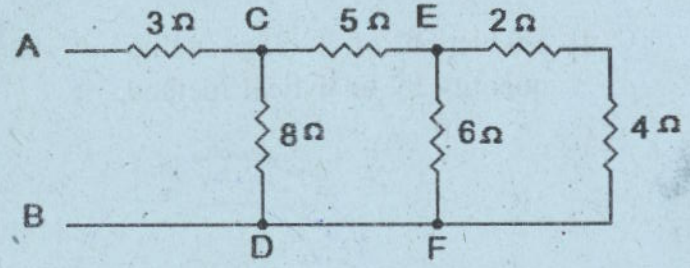

Fig.II

9. (a) What is the significance of the j-operator ? 3

   (b) A Wheatstone bridge ABCD is arranged as follows: AB = 1Ω; BC = 2Ω, CD = 3Ω; DA = 4Ω. A resistance of 5Ω is connected between B and D. A 4-volt battery of internal resistance 1Ω is connected between A and C. Calculate

   (i) the magnitude and direction of current in 5Ω resistor and

   (ii) the resistance between A and C. 6

10. Write short notes on any *three* : 3×3=9

(a) Transient response on a R-L circuit

(b) Norton's theorem

(c) R-L-C series circuit

(d) Deduction of average value of alternating quantity by analytical method.