

17323

13141

3 Hours / 100 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
(2) Illustrate your answers with neat sketches wherever necessary.
(3) Figures to the right indicate full marks.
(4) Assume suitable data, if necessary.
(5) Preferably, write the answers in sequential order.

Marks

1. Attempt any **TEN** of the following: 20
- a) Define time period and amplitude related to sinusoidal ac waveform.
- b) Find frequency and RMS value of the voltage waveform shown in Fig. No. 1.

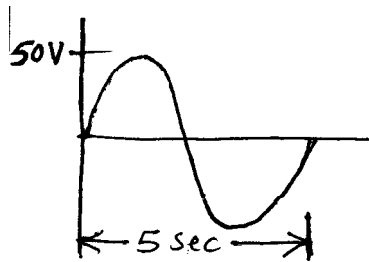


Fig. No. 1

- c) Define active and reactive power in case of series ac circuit.
- d) Define power factor and quality factor of a coil in series ac circuit.
- e) Define conductance and susceptance related to parallel circuits. Also write the mathematical equation.

P.T.O.

- f) Draw graphical representation of impedance and power factor with respect to frequency in series resonant circuit.
- g) Define balanced and unbalanced load in case of polyphase circuits.
- h) Draw the sinusoidal waveform of 3-phase emf with respect to time.
- i) Write the procedure of converting a given practical voltage source into current source.
- j) State Norton's theorem applied to DC circuits.
- k) State maximum power transfer theorem applied to DC circuits.
- l) State the behaviour of following elements at the time of switching i.e. transient period
 - i) Pure L
 - ii) Pure C

2. Attempt any **FOUR** of the following:

16

- a) An alternating current is represented by $i = 70.7 \sin 520 t$. Determine:
 - i) the frequency
 - ii) the current 0.0015 second after passing through zero, increasing positively.
- b) For the given impedance triangle shown in Fig. No. 2.
 - i) Identify the type of circuit.
 - ii) Mark parameters of all sides of the triangle.
 - iii) State the nature of power factor.
 - iv) Draw sinusoidal waveform for voltage and currents.

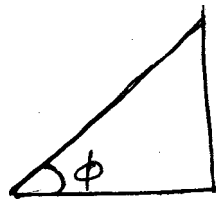


Fig. No. 2

- c) Two circuits the impedances of which are given by $z_1 = 6 + j8$ ohm and $z_2 = 8 - j6$ ohm are connected in parallel. If the applied voltage to the combination is 100 V, find
- Current and power factor of each branch
 - Overall current and power factor of the combination
 - Power consumed by each impedance.

Draw a neat phasor diagram.

- d) State any four advantages of polyphase circuits over single phase circuit.
- e) Using mesh analysis, find loop currents I_1 and I_2 in the Fig. No. 3.

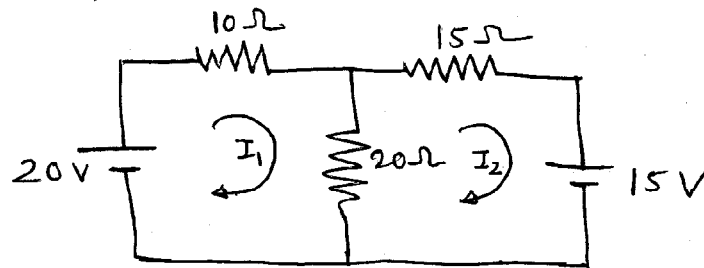


Fig. No. 3

- f) Explain the concept of initial and final conditions in switching circuits for the elements R, L and C.

3. Attempt any FOUR of the following:

16

- a) Derive the expression for current in pure inductive circuit when connected to sinusoidal ac voltage. Draw the phasor diagram.

- b) In a series circuit containing pure resistance and pure inductance the current and voltage is expressed as

$$i(t) = 5 \sin \left(314t + 2\pi/3 \right) \text{ and } v(t) = 15 \sin \left(314t + 5\pi/6 \right)$$

- What is the impedance of the circuit.
- What is the value of resistance
- What is the inductance in henries.
- What is the average power drawn by the circuit.

- c) A series combination of a resistance of 100 ohm and capacitance of 50 μf is connected in series to a 230 V, 50 Hz supply. Calculate
- Capacitive reactance
 - Current
 - Power factor of the circuit
 - Power consumed.
- d) Explain the phenomenon of resonance in parallel circuit by drawing a parallel electric circuit.
- e) Derive the formulae for star to delta transformation.
- f) Three coils each having a resistance of 20 ohm and a reactance of 15 ohm are connected in star to a 400 V, 3-phase, 50 Hz supply. Calculate
- Line current
 - Power supplied
 - Power factor.

4. Attempt any **FOUR** of the following:

16

- a) A 50 μf capacitor is connected across a 230 V, 50 Hz supply. Calculate
- the reactance offered by the capacitance
 - maximum current
 - the rms value of current drawn by the capacitance.
- b) A series circuit has the following characteristics
- $$R = 10\Omega, L = \frac{100}{\pi} \text{ mH}, C = \frac{500}{\pi} \mu\text{f}.$$
- Find
- the current flowing when the applied voltage is 100 V, 50 Hz.
 - The power factor of the circuit.
 - What value of supply frequency would produce series resonance.

- c) Compare series and parallel resonating circuits on the basis of
- Resonating frequency
 - Impedance
 - Current
 - Magnification.
- d) Three similar inductors each of resistance 10 ohm and inductance 0.019 H are connected in delta to a 3-phase, 415 V, 50 Hz supply. Calculate
- Line current
 - The power factor
 - Power input to the circuit.
- e) By using Nodal analysis calculate the current in 132Ω resistor and p.d. across 20Ω resistor as shown in Fig. No. 4.

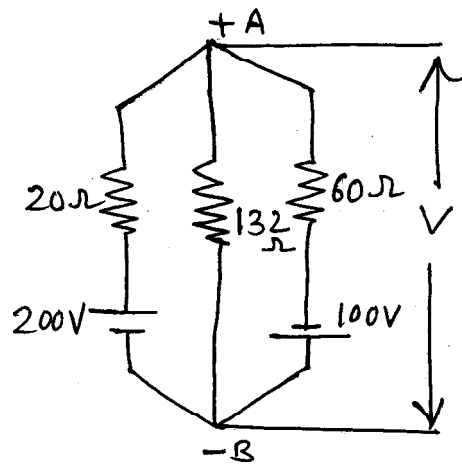


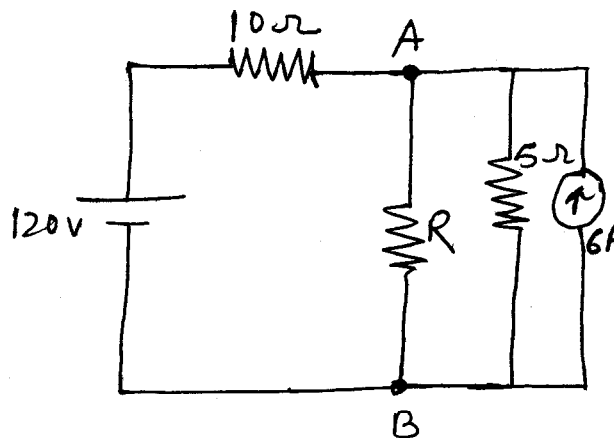
Fig. No. 4

- f) State Thevenin's theorem and write its procedural steps to find current in a branch (assume a simple circuit).

5. Attempt any TWO of the following:

16

- a) A coil has resistance of 10 ohm and inductance of 0.12733 H. This coil is connected in series with a capacitor of $230 \mu\text{f}$ across the source of supply of 230 V, 50 Hz. Find
- X_L
 - X_C
 - Voltage across coil and capacitor
 - Power factor
 - Z
 - Current
 - Angle of phase displacement between voltage and current.
- b) With the help of necessary phasor diagram, derive the relationship between line and phase voltage in balanced star connected load, connected to a 3-phase AC supply.
- c) Calculate the value of R which will absorb maximum power from the circuit of Fig. No. 5, Also compute the value of maximum power.

Fig. No. 5

6. Attempt any **FOUR** of the following:

16

- a) A 50 Hz voltage of 230 V effective value is impressed on an inductance of 0.265 H.
- Write the time equation for the voltage and the resulting current. Let the zero axis of the voltage wave be at $t = 0$.
 - Show the voltage and current on a phasor diagram.
 - Find the maximum energy stored in the inductance.
- b) A coil of resistance 20 ohm and inductance of 200 μH is in parallel with a variable capacitor. This combination is in series with a resistance of 8000 ohm. The voltage of the supply is 200 V and at a frequency of 10^6 Hz. Calculate
- The value of C to give resonance
 - The Q of the coil and
 - Dynamic resistance of the circuit.
- c) Using Nodal analysis, calculate the current distribution for the circuit shown in Fig. No. 6.

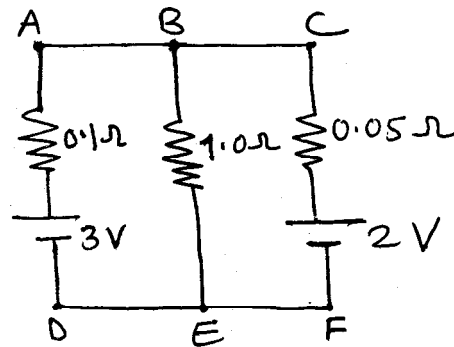


Fig. No. 6

- d) Apply super position theorem to Fig. No. 7 for determining the current in $100\ \Omega$ resistance.

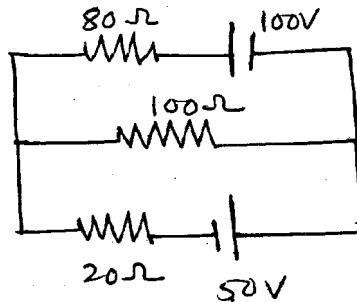


Fig. No. 7

- e) Find the current in $10\ \Omega$ resistance of the circuit shown in Fig. No. 8 using Thevenin's theorem.

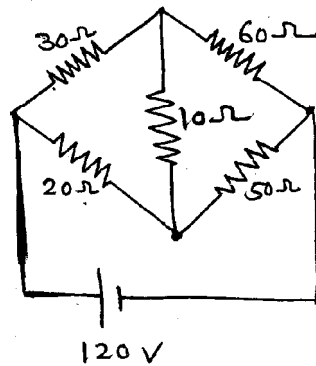


Fig. No. 8

- f) Using Norton's theorem, find the constant currents equivalent of the circuit shown in Fig. No. 9.

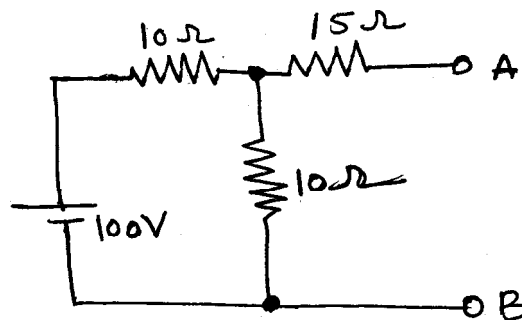


Fig. No. 9

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