

Electrical Circuits and Network (313332)

MSBTE Diploma · K-Scheme · Model Question Paper — Set C

Time: 3 Hours**Max. Marks: 70****Instructions:**

1. All questions are compulsory.
2. Answer each next main question on a new page.
3. Illustrate your answers with neat sketches wherever necessary.
4. Figures to the right indicate full marks.
5. Assume suitable data, if necessary.
6. Mobile phone, pager and any other electronic communication devices are not permissible in the examination hall.

Q.1 Attempt any FIVE of the following:**10**

- a) Define RMS value and form factor of an alternating quantity.
- b) Draw the voltage triangle and phasor diagram of an R-C series circuit.
- c) Define conductance and susceptance with reference to an AC parallel circuit. State their units.
- d) What is meant by phase sequence? State its importance.
- e) Define: i) Branch ii) Loop.
- f) State Thevenin's theorem.
- g) State the condition for maximum power transfer in a DC network and write the expression for maximum power.

Q.2 Attempt any THREE of the following:**12**

- a) In a series circuit the applied voltage and current are $v = 200 \sin(314t + 30^\circ)$ V and $i = 8 \sin(314t - 15^\circ)$ A. Find: i) Impedance ii) Resistance iii) Inductance iv) Power factor and power consumed.
- b) Two impedances $Z_1 = (12 + j16) \Omega$ and $Z_2 = (10 - j10) \Omega$ are connected in parallel. The total current is 20 A. Find the current and power taken by each impedance and the overall power factor.
- c) Draw the waveforms and phasor diagram of three-phase voltages. Write the equations of their instantaneous values and express them in polar form.

- d) Using node analysis, find the current through the $2\ \Omega$ resistor in the network of Fig. No. 1.

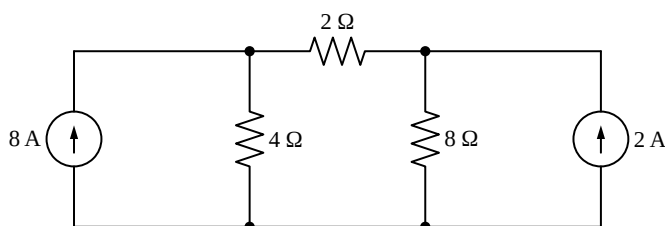


Fig. No. 1

Q.3 Attempt any THREE of the following:

12

- With reference to a purely inductive AC circuit: i) Draw the circuit diagram ii) Draw the waveforms of voltage and current iii) Draw the phasor diagram iv) Write the equations of voltage and current.
- Differentiate between series resonant and parallel resonant circuits. (Any four points)
- A three-phase, 400 V, 50 Hz supply is connected to a balanced delta load. Each phase has $R = 15\ \Omega$, $L = 0.05\ \text{H}$ and $C = 300\ \mu\text{F}$ in series. Determine: i) Z_{ph} ii) I_{ph} iii) I_L iv) Power factor.
- Using mesh analysis, determine the current in the $4\ \Omega$ resistor in Fig. No. 2.

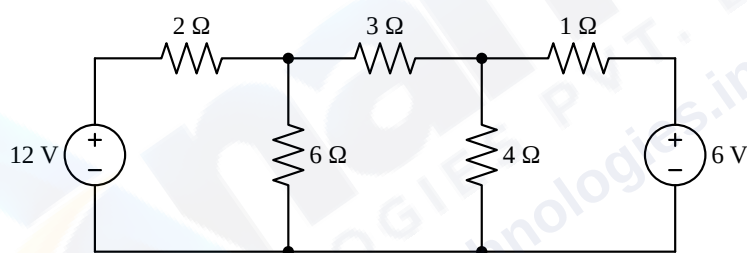


Fig. No. 2

Q.4 Attempt any THREE of the following:

12

- A series R-L-C circuit with $R = 6\ \Omega$, $L = 40\ \text{mH}$ and $C = 25\ \mu\text{F}$ is connected to a 120 V variable frequency supply. Find: i) Resonant frequency ii) Current at resonance iii) Q-factor iv) Lower and upper half-power frequencies.
- Derive the expression for resonant frequency and dynamic impedance of a parallel circuit consisting of a coil (R-L) in parallel with a capacitor.
- Compare single-phase and three-phase AC systems. (Any four points)

- d) Using source transformation technique, find the current through the $8\ \Omega$ resistor R_L in Fig. No. 3.

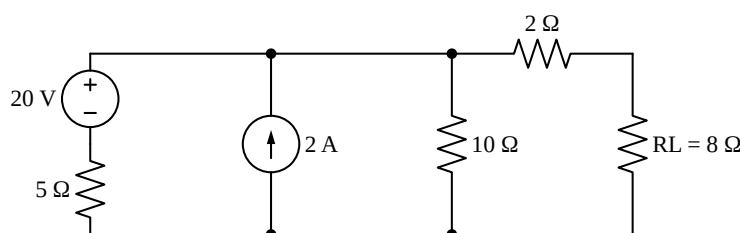


Fig. No. 3

- e) Verify reciprocity theorem for the network of Fig. No. 4, taking the response as the current in the $3\ \Omega$ resistor.

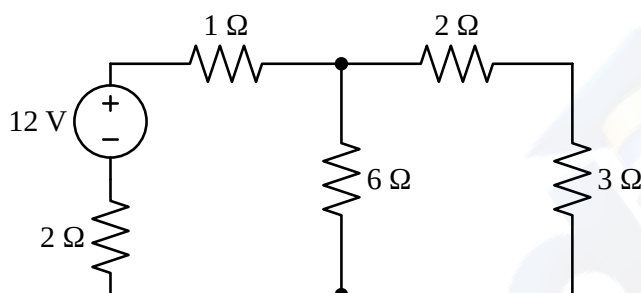


Fig. No. 4

Q.5 Attempt any TWO of the following:

12

- Draw and explain the variation of X_L , X_C , R , Z and current I with frequency in a series R-L-C circuit. Mark the resonant frequency and bandwidth on the curve.
- A balanced star connected load is supplied from a 400 V, 50 Hz, three-phase supply. The line current is 12 A and the total power is 6 kW at a leading power factor. Find: i) Power factor ii) Resistance per phase iii) Capacitance per phase iv) Total reactive power.
- Using superposition theorem, find the current through the $10\ \Omega$ resistor in Fig. No. 5.

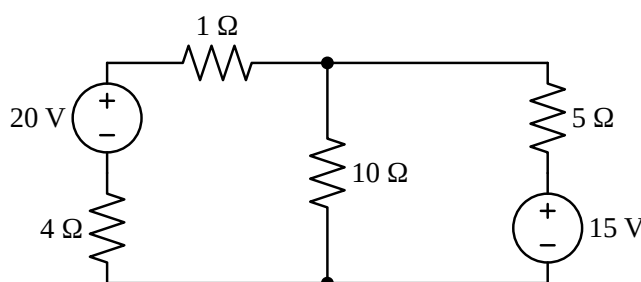


Fig. No. 5

Q.6 Attempt any TWO of the following:

12

- State different types of power in an AC circuit with their units and explain power factor. Draw the power triangle for an R-L series circuit. A load takes 10 kW at 0.8 lagging power factor; find its kVA and kVAR.
- Using Thevenin's theorem find the current through $R_L = 8\ \Omega$ in Fig. No. 6. Also find the value of R_L for maximum power transfer and the maximum power.

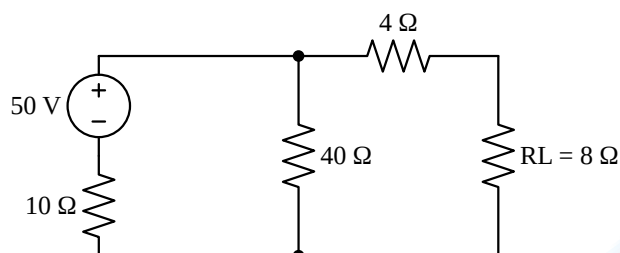


Fig. No. 6

- Using Norton's theorem, find the current through the $3\ \Omega$ load resistor R_L in Fig. No. 7.

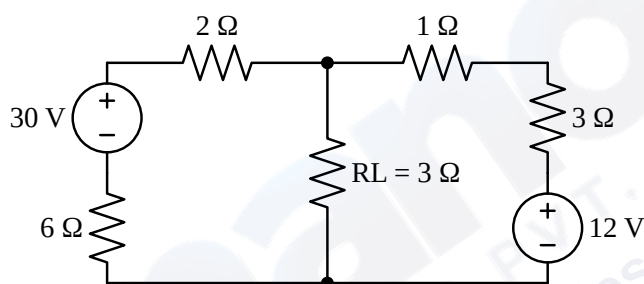


Fig. No. 7

Note: This is a **model question paper prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — anandatechnologies.in