

Electrical Circuits and Network (313332)

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

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: i) Frequency ii) Phase difference, with respect to an alternating quantity.
- b) Define admittance and susceptance. State their units.
- c) State the relationship between line and phase values of voltage and current in a balanced delta connected system.
- d) Draw the circuit symbols of an ideal and a practical voltage source. State the internal resistance of each.
- e) Define: i) Node ii) Mesh.
- f) State Norton's theorem.
- g) State the maximum power transfer theorem for DC circuits.

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

- a) A series circuit consists of a resistance of $8\ \Omega$, an inductance of 0.05 H and a capacitance of $120\ \mu\text{F}$. It is connected to a 230 V , 50 Hz supply. Calculate: i) Impedance ii) Current iii) Power factor iv) Active power.
- b) Two impedances $Z_1 = (6 + j8)\ \Omega$ and $Z_2 = (4 - j3)\ \Omega$ are connected in parallel across a 120 V , 50 Hz supply. Find the branch currents, total current and overall power factor. Draw the phasor diagram.
- c) Derive the relationship between line voltage and phase voltage for a balanced star connected system with the help of a neat phasor diagram.

- d) Using mesh analysis, find the current flowing through the $6\ \Omega$ resistor in the network shown in Fig. No. 1.

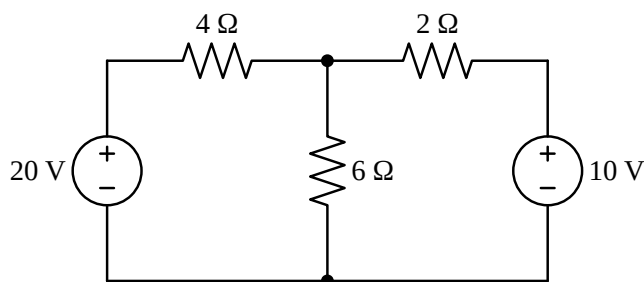


Fig. No. 1

Q.3 Attempt any THREE of the following:

12

- Draw the phasor diagram and impedance triangle for an R-L series circuit. Write the equations of instantaneous voltage and current.
- Compare series resonance and parallel resonance on the basis of: i) Impedance ii) Current iii) Magnification iv) Resonant frequency.
- A balanced star connected load has a resistance of $12\ \Omega$ and an inductive reactance of $16\ \Omega$ in each phase. It is connected to a 400 V, 50 Hz, three-phase supply. Find: i) Line current ii) Power factor iii) Total active power iv) Total reactive power.
- Using source transformation, find the current through the $6\ \Omega$ load resistor R_L in Fig. No. 2.

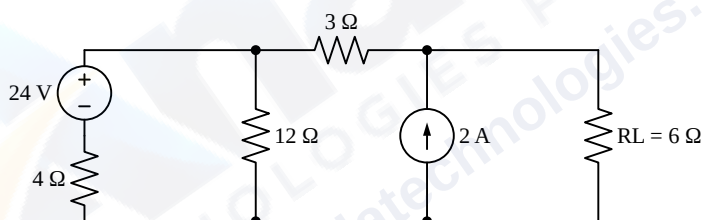


Fig. No. 2

Q.4 Attempt any THREE of the following:

12

- A series R-L-C circuit has $R = 4\ \Omega$, $L = 0.1\ \text{H}$ and $C = 20\ \mu\text{F}$ and is connected to a 50 V variable frequency supply. Calculate: i) Resonant frequency ii) Current at resonance iii) Q-factor iv) Bandwidth.
- Explain current magnification in a parallel resonant circuit consisting of a coil (R-L) in parallel with a capacitor C. Derive the expression for it.

- c) Using nodal analysis, find the current through the $4\ \Omega$ resistor in the network shown in Fig. No. 3.

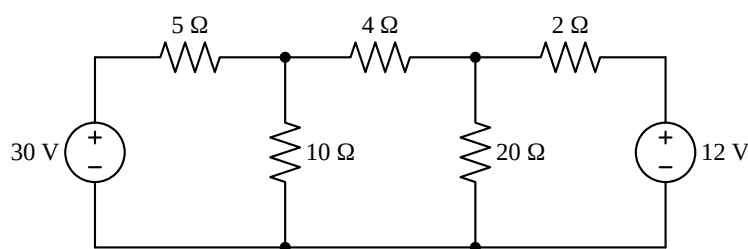


Fig. No. 3

- d) Using superposition theorem, find the current through the $6\ \Omega$ resistor in Fig. No. 4.

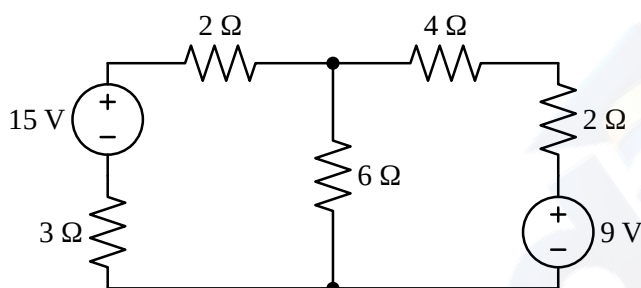


Fig. No. 4

- e) State reciprocity theorem. Verify it for the network shown in Fig. No. 5 by interchanging the 20 V source and the ammeter placed in the $6\ \Omega$ branch.

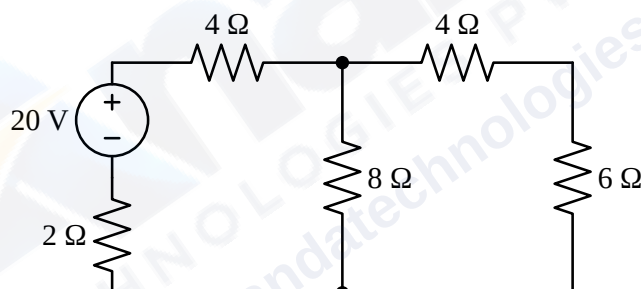


Fig. No. 5

Q.5 Attempt any TWO of the following:

12

- Explain graphical representation of resonance in a series R-L-C circuit. Draw the variation of X_L , X_C , Z and I with frequency and state the meaning of each term.
- A three-phase, 415 V, 50 Hz supply feeds a balanced delta connected load. Each phase consists of a resistance of $20\ \Omega$, an inductance of 0.1 H and a capacitance of $200\ \mu\text{F}$ in series. Find: i) Impedance per phase ii) Phase current iii) Line current iv) Power factor v) Total power. Draw the phasor diagram.

- c) Using Thevenin's theorem, find the current through $R_L = 4 \Omega$ in Fig. No. 6.
Draw the Thevenin equivalent circuit.

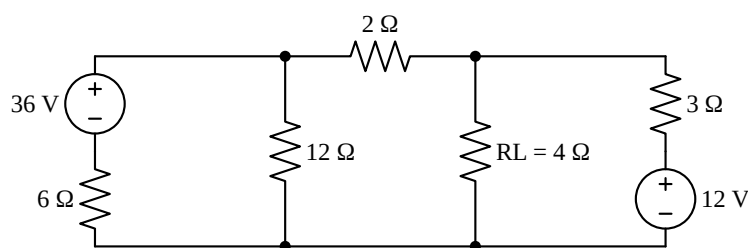


Fig. No. 6

Q.6 Attempt any TWO of the following:

12

- a) Two impedances $Z_1 = (5 + j12) \Omega$ and $Z_2 = (8 - j6) \Omega$ are connected in parallel. The total current drawn by the combination is 20 A. Find: i) Supply voltage ii) Power taken by each branch iii) Power factor of each branch and of the combination. Draw the phasor diagram.
- b) Using Norton's theorem, find the current through the 6Ω resistor R_L in Fig. No. 7.

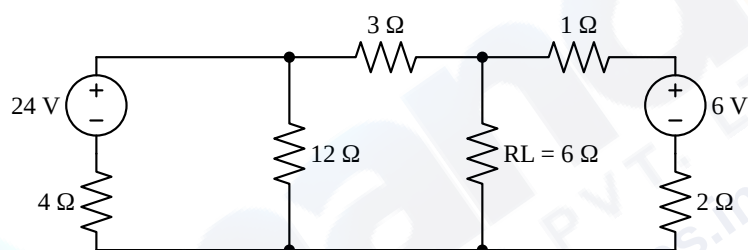


Fig. No. 7

- c) State maximum power transfer theorem. Find the value of load resistance R_L to be connected across A-B in Fig. No. 8 for maximum power transfer and calculate the maximum power.

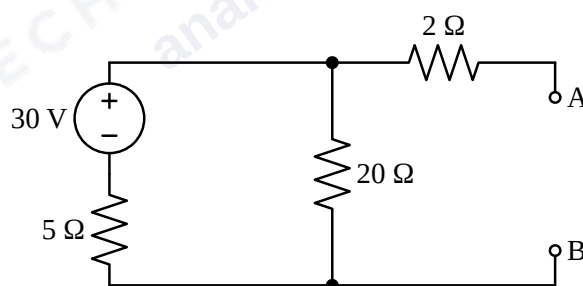


Fig. No. 8

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