

Circuits and Networks (313325)

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: i) Linear network ii) Bilateral network
- b) State reciprocity theorem.
- c) State the units of: i) Impedance ii) Reactance iii) Admittance iv) Susceptance
- d) Draw the phasor diagram and waveforms of voltage and current for a purely capacitive circuit.
- e) Define two-port network. Draw its general block diagram showing port voltages and currents.
- f) Define: i) Q-factor of a coil ii) Bandwidth of a resonant circuit
- g) State superposition theorem.

Q.2 Attempt any THREE of the following:
12

- a) Write the steps to solve a network by nodal analysis. Explain with the help of the simple example shown in Fig. No. 1.

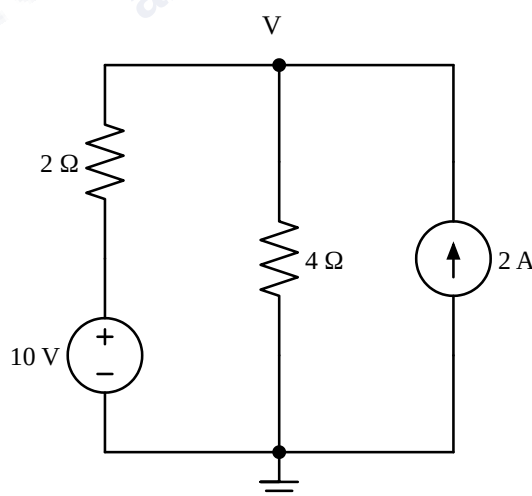


Fig. No. 1

- b) Explain ideal and practical voltage source and current source with circuit symbols and V-I characteristics.
- c) Draw the phasor diagram, impedance triangle and power triangle of a series R-L-C circuit when $X_L < X_C$.
- d) Write the equations of transmission (ABCD) parameters. Define A, B, C, D and state the conditions of reciprocity and symmetry.

Q.3 Attempt any THREE of the following:

12

- a) Using mesh analysis, find the current through the $6\ \Omega$ resistor in the network shown in Fig. No. 2.

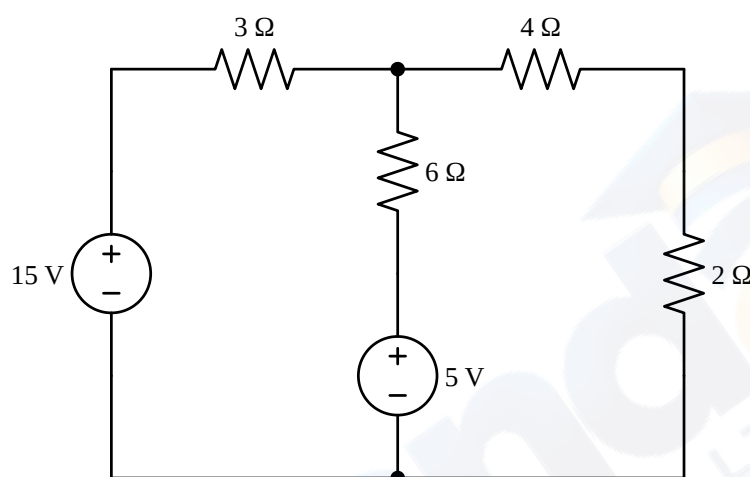


Fig. No. 2

- b) Find the value of R_L for maximum power transfer and the maximum power for the network shown in Fig. No. 3.

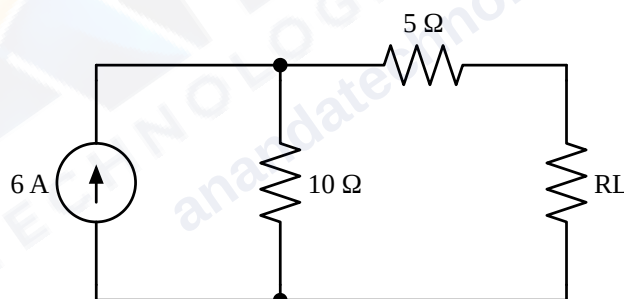


Fig. No. 3

- c) Explain the variation of current and power factor with frequency in a series R-L-C circuit. Draw the curves.
- d) State the features and applications of a symmetrical π attenuator. Draw its circuit.

Q.4 Attempt any THREE of the following:

12

- a) Find the equivalent resistance between terminals A and B of the network shown in Fig. No. 4.

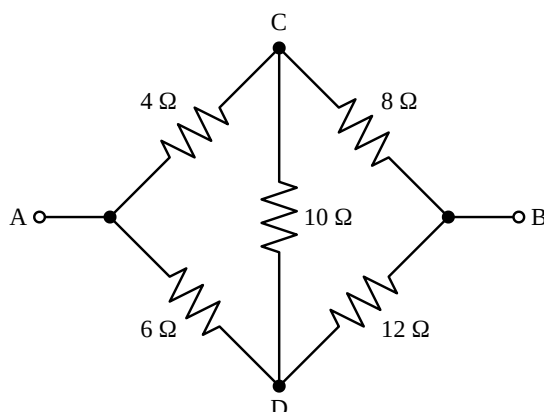


Fig. No. 4

- b) Using superposition theorem, find the current through the $6\ \Omega$ resistor in the network shown in Fig. No. 5.

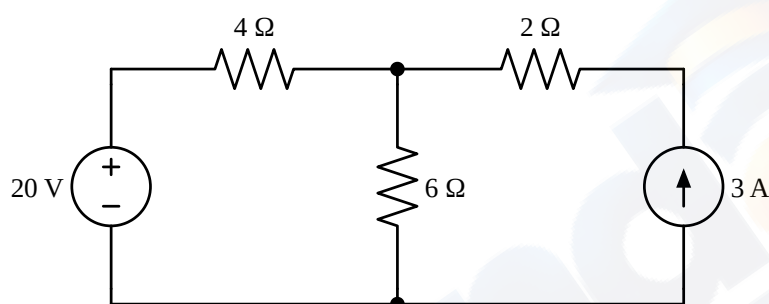


Fig. No. 5

- c) Find the Y-parameters of the π -network shown in Fig. No. 6.

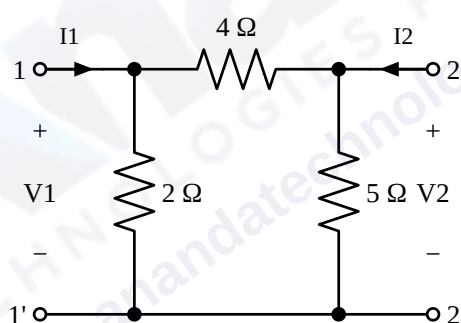


Fig. No. 6

- d) A coil draws a current of 5 A from 230 V, 50 Hz supply and consumes 600 W. Calculate: i) Resistance ii) Inductive reactance iii) Inductance iv) Power factor of the coil.
- e) Derive the expression for resonant frequency of a parallel resonant circuit (coil in parallel with a capacitor). Write the expression for dynamic impedance.

Q.5 Attempt any TWO of the following:

12

- a) Find the Thevenin's equivalent circuit across R_L for the network shown in Fig. No. 7. Hence find the current through R_L when $R_L = 2\ \Omega$, $4\ \Omega$ and $6\ \Omega$.

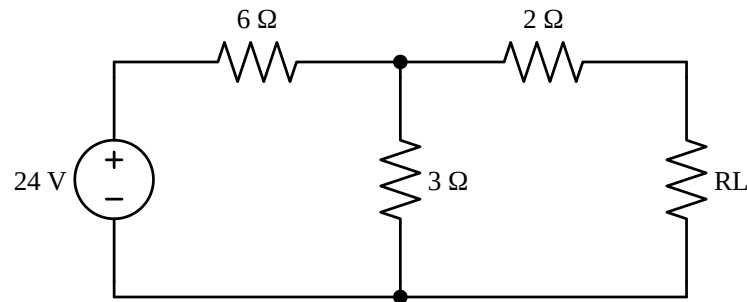


Fig. No. 7

- b) A series circuit has $R = 8\ \Omega$, $L = 0.05\text{ H}$ and $C = 150\ \mu\text{F}$ connected across 230 V, 50 Hz supply. Calculate: i) Impedance ii) Current iii) Power factor iv) Active, reactive and apparent power. Draw the phasor diagram and power triangle.
- c) Find the Norton's equivalent circuit across terminals A-B for the network shown in Fig. No. 8 and find the current through a load of $8\ \Omega$ connected across A-B.

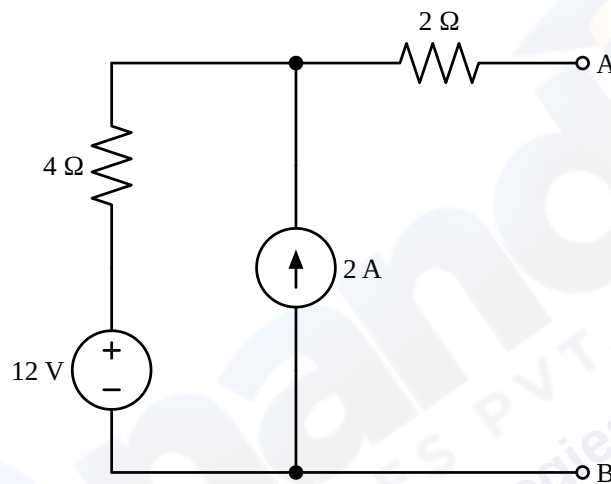


Fig. No. 8

Q.6 Attempt any TWO of the following:

12

- a) Using nodal analysis, find the node voltages V_1 , V_2 , V_3 and the power dissipated in the $6\ \Omega$ resistor for the network shown in Fig. No. 9.

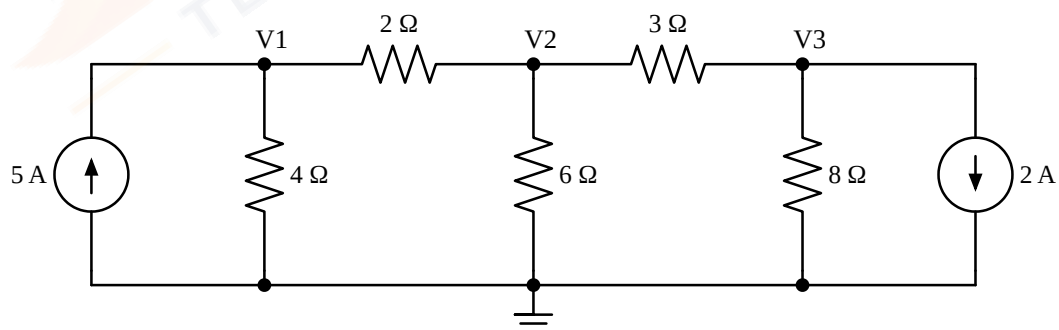


Fig. No. 9

- b) A coil of resistance $5\ \Omega$ and inductance 0.04 H is connected in parallel with a capacitor of $100\ \mu\text{F}$ across 230 V variable-frequency supply. Calculate: i)

- Resonant frequency ii) Dynamic impedance iii) Supply current at resonance iv) Current in each branch at resonance. Draw the phasor diagram at resonance.
- c) Define high pass filter. Draw an R-C high pass filter and its frequency response. Calculate its cut-off frequency for $R = 4.7 \text{ k}\Omega$ and $C = 0.01 \text{ }\mu\text{F}$. Write any two applications.

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

