

Circuits and Networks (313325)

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 the following terms: i) Node ii) Mesh
- b) State Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL).
- c) State Norton's theorem.
- d) Define active power and reactive power. Write their units.
- e) State the condition for resonance in a series R-L-C circuit and write the formula for resonant frequency.
- f) Write the equations of open circuit impedance (Z) parameters of a two-port network.
- g) Define pass band, stop band and cut-off frequency of a filter.

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

- a) A practical voltage source has an emf of 24 V and internal resistance of 4 Ω . Convert it into an equivalent practical current source. Draw both circuits and write the conversion steps.
- b) State superposition theorem. Write the steps to find current through a branch using superposition theorem. List any two limitations of the theorem.
- c) Draw the phasor diagram, impedance triangle and power triangle of a series R-L-C circuit when $X_L > X_C$.
- d) A coil having resistance of 30 Ω and inductance of 0.12 H is connected across 230 V, 50 Hz supply. Calculate: i) Inductive reactance ii) Impedance iii) Current iv) Power factor and power consumed.

Q.3 Attempt any THREE of the following:**12**

- a) Find the equivalent resistance between terminals A and B for the network shown in Fig. No. 1.

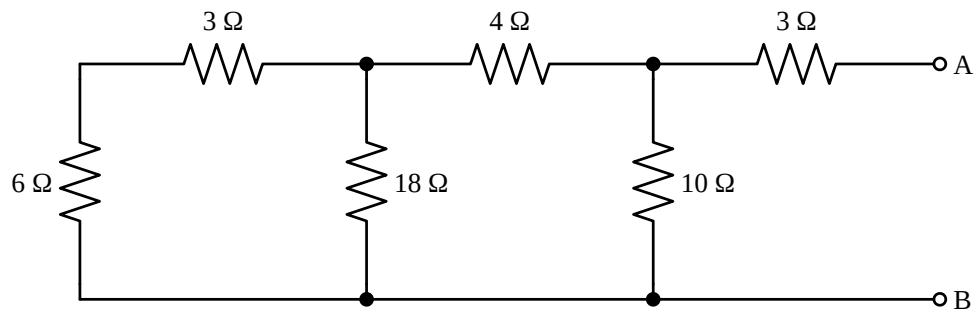


Fig. No. 1

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

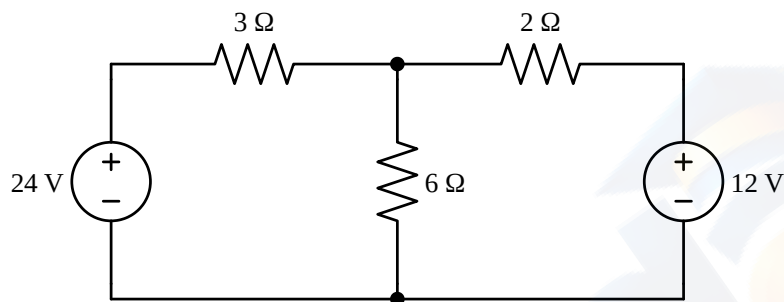


Fig. No. 2

- c) Derive the expression for resonant frequency of a series R-L-C circuit.
d) Compare T and π attenuators. (Any four points)

Q.4 Attempt any THREE of the following:

12

- a) Using Thevenin's theorem, find the current through the load resistance $R_L = 5\ \Omega$ in the network shown in Fig. No. 3.

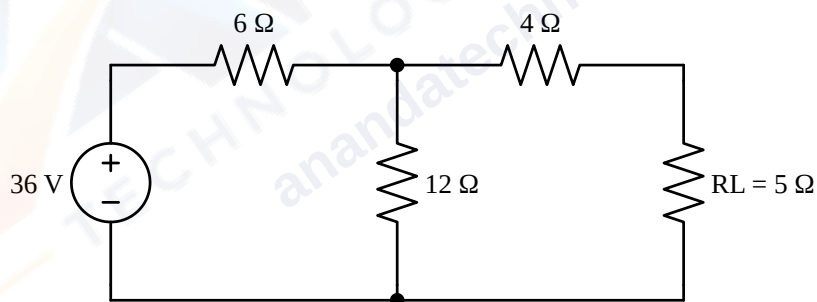


Fig. No. 3

- b) Using nodal analysis, find the node voltages V_1 , V_2 and the current through the $6\ \Omega$ resistor for the network shown in Fig. No. 4.

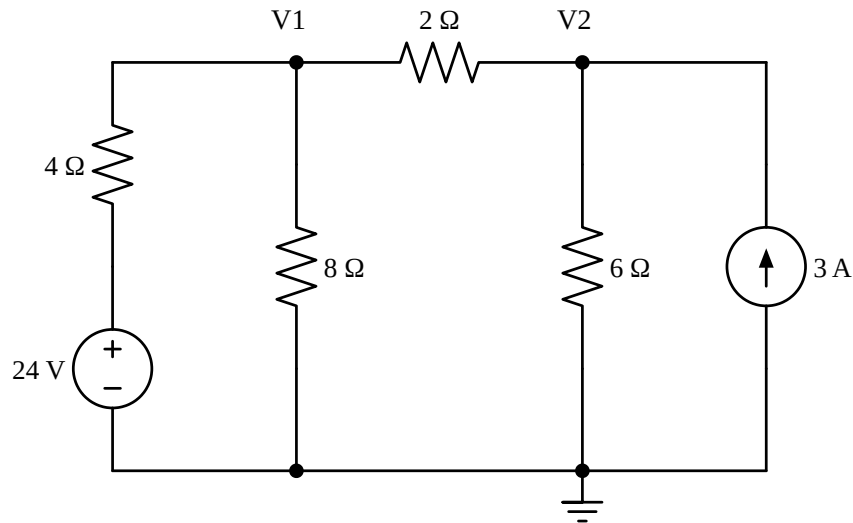


Fig. No. 4

- c) Find the Z-parameters of the T-network shown in Fig. No. 5. Is the network reciprocal? Is it symmetrical?

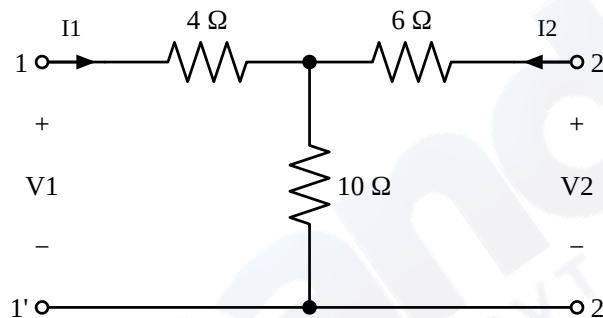


Fig. No. 5

- d) A series R-C circuit has $R = 20\ \Omega$ and $C = 100\ \mu\text{F}$. It is connected across 230 V, 50 Hz supply. Calculate: i) Capacitive reactance ii) Impedance iii) Current iv) Power factor v) Power consumed.
- e) Draw an R-C low pass filter and its frequency response. Write the expression for cut-off frequency and calculate it for $R = 1\ \text{k}\Omega$ and $C = 0.1\ \mu\text{F}$.

Q.5 Attempt any TWO of the following:

12

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

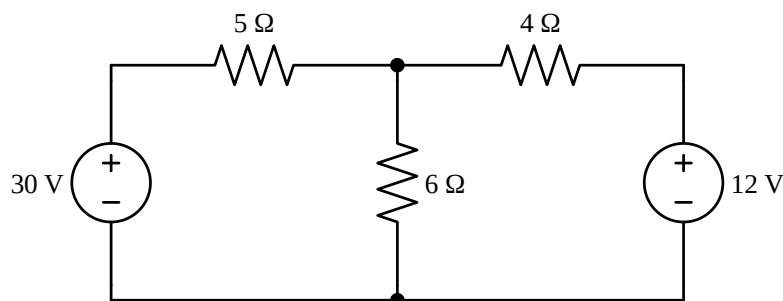


Fig. No. 6

- b) A coil of resistance $12\ \Omega$ and inductance $0.08\ \text{H}$ is connected in series with a capacitor of $80\ \mu\text{F}$ across $230\ \text{V}$, $50\ \text{Hz}$ supply. Calculate: i) Impedance ii) Current iii) Power factor iv) Voltage across the coil and across the capacitor. Draw the phasor diagram.
- c) Draw the two-port network interconnections: i) Cascade ii) Series iii) Parallel. State which parameters are used / added for each connection.

Q.6 Attempt any TWO of the following:

12

- a) Find the value of load resistance R_L for which maximum power is transferred to it in the network shown in Fig. No. 7. Also find the maximum power.

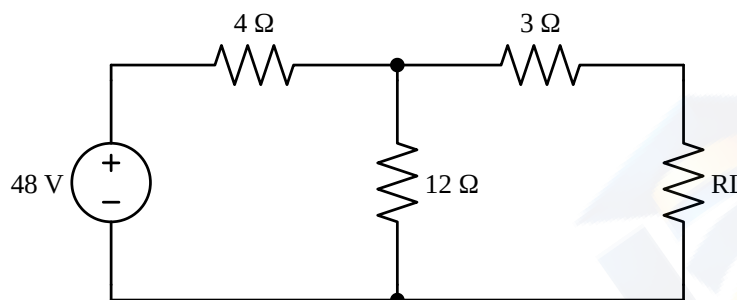


Fig. No. 7

- b) Compare series resonant circuit and parallel resonant circuit on the basis of: i) Resonant frequency ii) Impedance at resonance iii) Current at resonance iv) Magnification v) Power factor vi) Application
- c) A coil of resistance $10\ \Omega$ and inductance $0.2\ \text{H}$ is connected in parallel with a variable capacitor across $230\ \text{V}$, $50\ \text{Hz}$ supply. Calculate: i) Value of C for resonance ii) Q -factor of the coil iii) Dynamic impedance iv) Supply current at resonance.

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