

Electrical Circuits and Network (313332)

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

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 active power and reactive power. State their units.
- b) Draw the voltage and current waveforms and the phasor diagram for a purely capacitive circuit.
- c) Define Q-factor of a series resonant circuit and write its expression.
- d) State any four advantages of a three-phase system over a single-phase system.
- e) State the value of internal resistance of: i) an ideal voltage source ii) an ideal current source.
- f) State superposition theorem.
- g) State reciprocity theorem.

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

- a) A resistor and a capacitor are connected in series across a 100 V, 50 Hz supply. The current drawn is 2.5 A and the power consumed is 150 W. Calculate the values of resistance and capacitance, and the power factor.
- b) Two impedances $Z_1 = (8 + j6) \Omega$ and $Z_2 = (5 - j5) \Omega$ are connected in parallel across a 230 V, 50 Hz supply. Using the admittance method, find the branch currents, total current and power factor of the circuit.
- c) With the help of a neat phasor diagram, derive the relationship between line current and phase current in a balanced delta connected load.

- d) Convert the delta network shown in Fig. No. 1 into an equivalent star network.

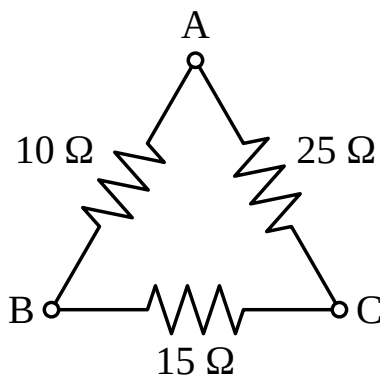


Fig. No. 1

Q.3 Attempt any THREE of the following:

12

- For a series R-L-C circuit draw the impedance triangle and voltage triangle for the cases: i) $X_L > X_C$ ii) $X_C > X_L$.
- State the features of a parallel resonant circuit. Draw the resonance curve for a parallel R-L-C circuit and state the meaning of each term on it.
- A balanced star connected load takes 15 kW at a lagging power factor from a 415 V, 50 Hz, three-phase supply. The line current is 25 A. Find: i) Power factor ii) Resistance per phase iii) Reactance per phase iv) Inductance per phase.
- Find the current through the 5 Ω resistor in Fig. No. 2 using mesh analysis.

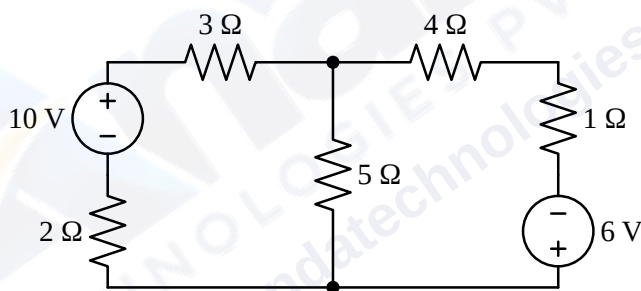


Fig. No. 2

Q.4 Attempt any THREE of the following:

12

- A voltage $v(t) = 325 \sin 314t$ volt is applied to a series circuit of $R = 15 \Omega$, $L = 0.08$ H and $C = 100 \mu\text{F}$. Find: i) Expression for $i(t)$ ii) Phase angle iii) Power factor iv) Active power.
- Compare star connection and delta connection. (Any four points)
- With a neat circuit diagram, explain how a practical current source is converted into an equivalent practical voltage source.
- State Thevenin's theorem. Write the stepwise procedure to solve a network using Thevenin's theorem.

- e) Find the Norton's equivalent circuit across terminals A-B for the network shown in Fig. No. 3.

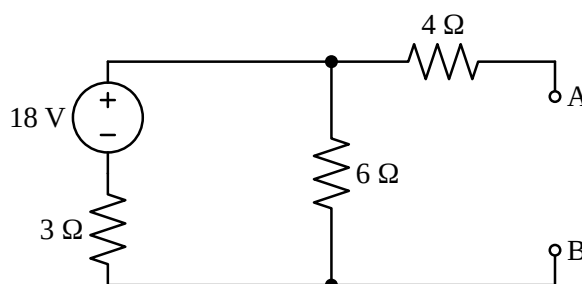


Fig. No. 3

Q.5 Attempt any TWO of the following:

12

- A coil of resistance $10\ \Omega$ and inductance $0.2\ \text{H}$ is connected in series with a capacitor of $50\ \mu\text{F}$ across a $100\ \text{V}$ variable frequency supply. Calculate: i) Resonant frequency ii) Current at resonance iii) Voltage across the coil and across the capacitor at resonance iv) Q-factor v) Bandwidth.
- A coil having a resistance of $15\ \Omega$ and an inductance of $0.25\ \text{H}$ is connected in parallel with a $40\ \mu\text{F}$ capacitor across a $230\ \text{V}$ supply. Find: i) Resonant frequency ii) Dynamic impedance iii) Current at resonance iv) Q-factor v) Power consumed.
- Using superposition theorem, find the current through the $6\ \Omega$ resistor in Fig. No. 4.

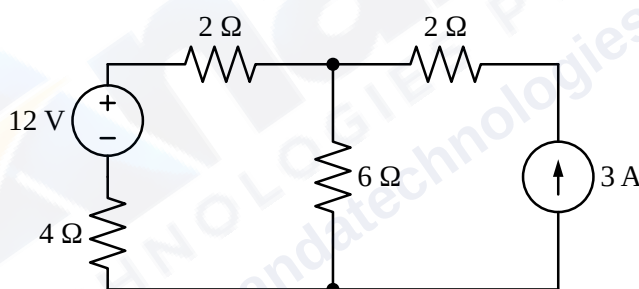


Fig. No. 4

Q.6 Attempt any TWO of the following:

12

- A balanced delta connected load of $(6 + j8)\ \Omega$ per phase is connected to a $415\ \text{V}$, $50\ \text{Hz}$, three-phase supply. Calculate: i) Phase current ii) Line current iii) Power factor iv) Active, reactive and apparent power. Draw the phasor diagram.
- A coil of resistance $6\ \Omega$ and inductance $0.04\ \text{H}$ is connected in parallel with a series combination of a $10\ \Omega$ resistor and a $150\ \mu\text{F}$ capacitor across a $230\ \text{V}$, $50\ \text{Hz}$ supply. Determine: i) Branch currents ii) Total current iii) Power factor of the circuit. Draw the phasor diagram.

- c) State maximum power transfer theorem and prove that $P_{\max} = V_{\text{Th}}^2 / 4R_L$. Find the value of R_L across A-B in Fig. No. 5 for maximum power and the value of maximum power.

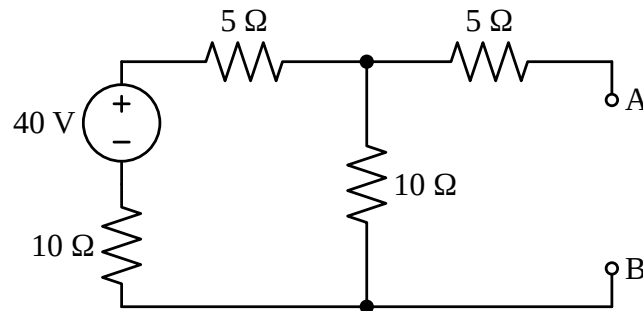


Fig. No. 5

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