

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM**  
**I B. Tech II Semester Supplementary Examinations January-2025**  
**Electrical Circuit Analysis - I**

(Only EEE)

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part A & Part B.*  
*Part A is compulsory, Answer all questions.*  
*In Part B, Answer any one question from each unit.*  
*Provide graph sheet to the students if required.*

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**PART-A****(20 Marks)**

- 1 a) Determine V in the circuit shown in figure-1. [2]

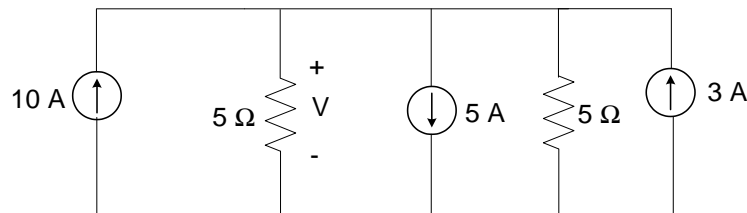


Figure:1

- b) State Kirchhoff's laws. [2]  
 c) Define the term coefficient of coupling w.r.t magnetic circuits. [2]  
 d) Explain the concept of Mutual Inductance. [2]  
 e) What is the significance of power factor in AC Circuits? [2]  
 f) The instantaneous value of emf is  $V = 300 \sin\left(80\frac{\pi}{4}t\right)$  volts. Determine average value and periodic time. [2]  
 g) What is the resonance frequency in a series RLC circuit. [2]  
 h) What is the significance of Locus Diagrams? [2]  
 i) State Reciprocity theorem. [2]  
 j) Draw the equivalent circuit of Norton's theorem and Thevenin's theorem. [2]

**PART-B****(50 Marks)****Unit-1**

- 2 a) Calculate the effective resistance between the points A and B in the circuit shown in figure.2. [5]

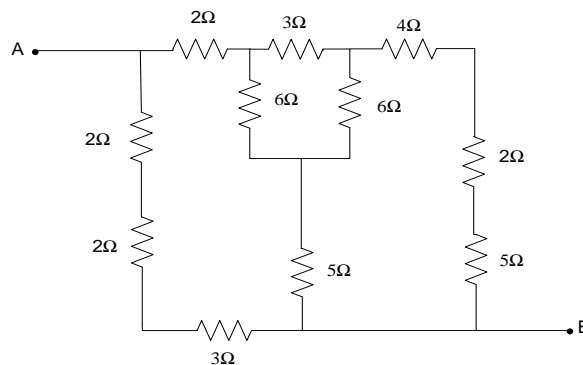


Figure:2

- b) Determine the mesh currents  $I_1$ ,  $I_2$  and  $I_3$  in the circuit shown in the figure. 3. [5]

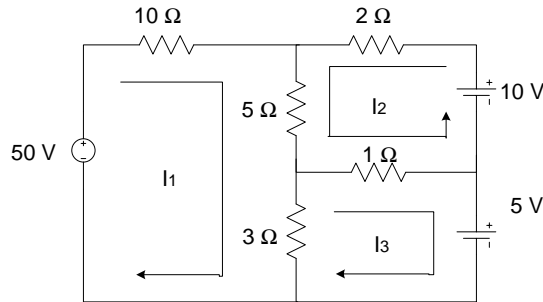


Figure:3

(OR)

- 3 a) Explain about Source transformation technique. [5]  
 b) Using nodal analysis, determine the voltage between the points, P and Q shown in figure.4. [5]

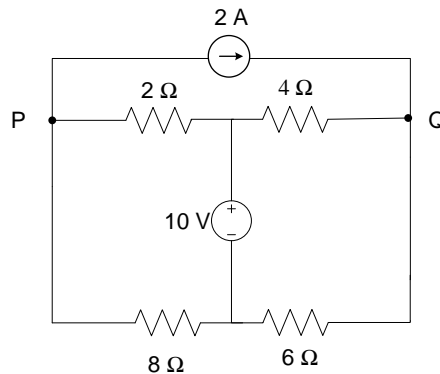


Figure:4

### Unit-2

- 4 a) Find the effective value of the inductance for the following connection shown in figure.5 [5]

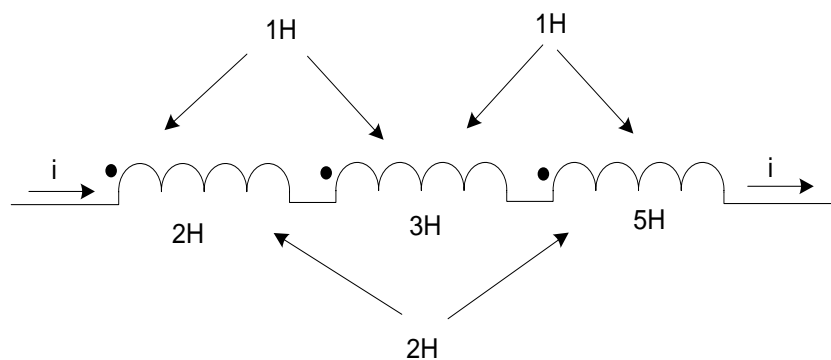


Figure:5

- b) A cast steel ring is wound with 500 turns. The cross-section of core is  $2 \times 10^{-3} \text{ m}^2$  and the mean length is 0.16m. (a) Find value of current required to develop a magnetic flux of  $\phi = 4 \times 10^{-4} \text{ wb}$ . (b) Determine the value of  $\mu$  and  $\mu_r$  for the material under these conditions. Assume  $H$  for cast steel = 170 At/m. [5]

(OR)

- 5 a) State and explain Faraday's laws of electromagnetic induction. [5]  
 b) Two coils of self-inductances  $L_1$  and  $L_2$  are mutually coupled. Derive the expression for the net inductance of the coils if they are connected in Series Aiding. [5]

### Unit-3

- 6 a) For the periodic wave form shown in figure.6, determine average and rms values. [5]

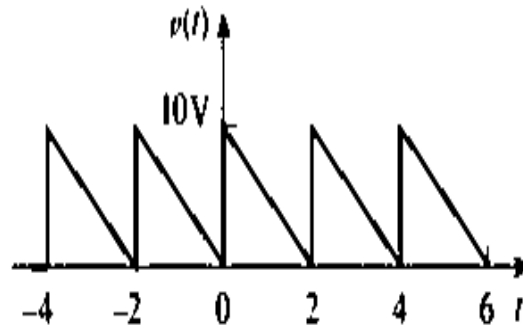


Figure:6

- b) For the circuit shown in figure.7, find [5]  
 i) the total impedance      ii) the total current      iii) Power factor

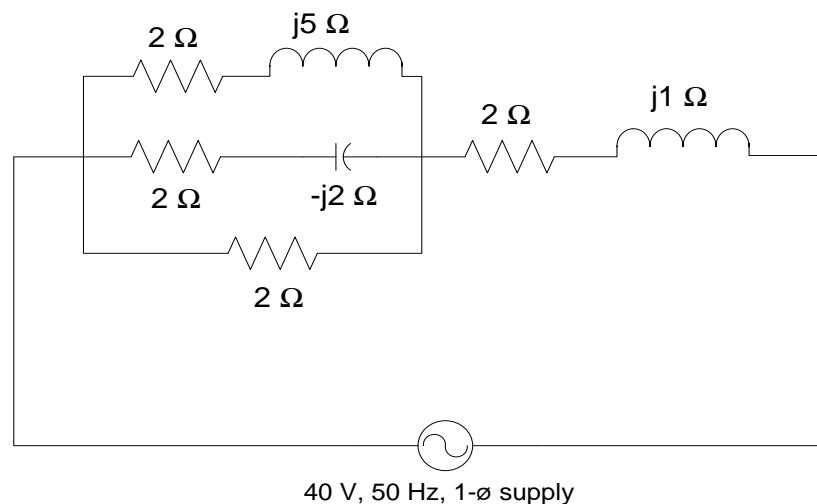


Figure:7

(OR)

- 7 a) For the circuit shown in figure.8, find the power delivered by the source. [5]

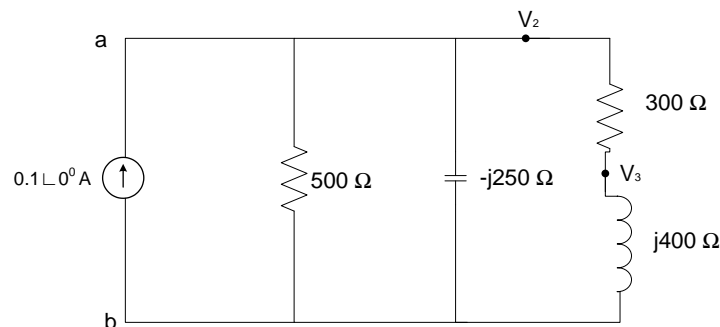


Figure:8

- b) If voltage  $v = 20 \sin(100t + 40^\circ)$  is applied to a  $60 \mu\text{F}$  capacitor, calculate the current through the capacitor. [5]

#### Unit-4

- 8 a) Explain the following terms related to resonance circuits: [5]  
 i) Band Width ii) Quality factor  
 b) For the series circuit shown figure.9, evaluate the value of reactance when the power factor is 0.866 lag using locus diagram. [5]

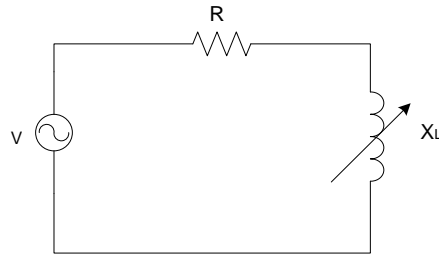


Figure:9

(OR)

- 9 a) An RLC series circuit consists of  $R=1\text{K}\Omega$ ,  $L=100\text{mH}$ ,  $C=10\mu\text{F}$ . If a voltage of 100V is applied across the combination, determine resonant frequency, quality factor and bandwidth. [5]  
 b) At resonance, the current is maximum in a series circuit and minimum in a parallel circuit. Why? [5]

#### Unit-5

- 10 a) State and explain maximum power transfer theorem with an example for DC excitation? [5]  
 b) For the circuit shown in figure.10, Compute the current flowing through the  $23\Omega$  resistor by applying Super position theorem. [5]

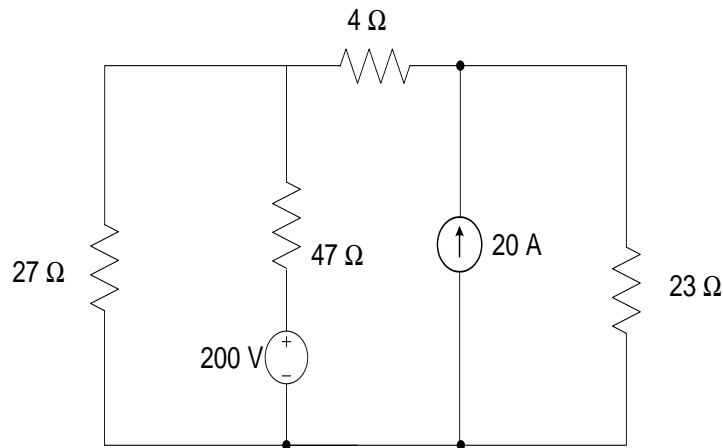


Figure:10

(OR)

- 11 a) In the network shown in figure.11, the  $5\Omega$  resistor is changed to  $8\Omega$ . Determine the resulting change in current through the  $(3+j4)\Omega$  impedance branch using compensation theorem. [5]

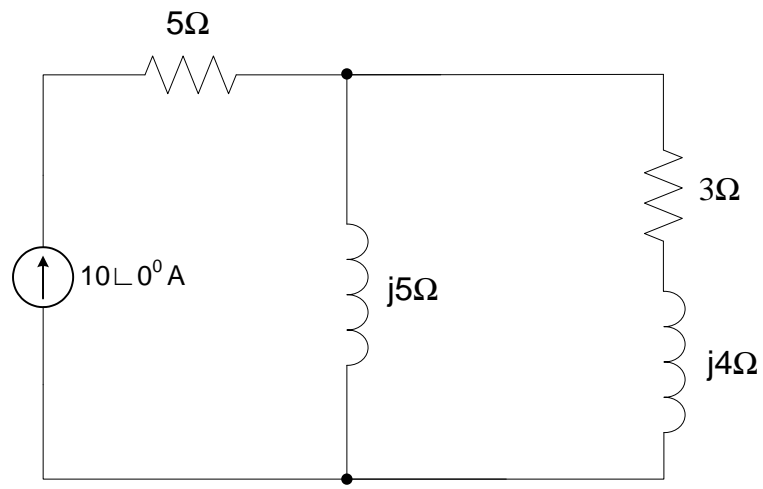


Figure:11

b) Find the Thevenin's equivalent for the circuit shown in figure.12.

[5]

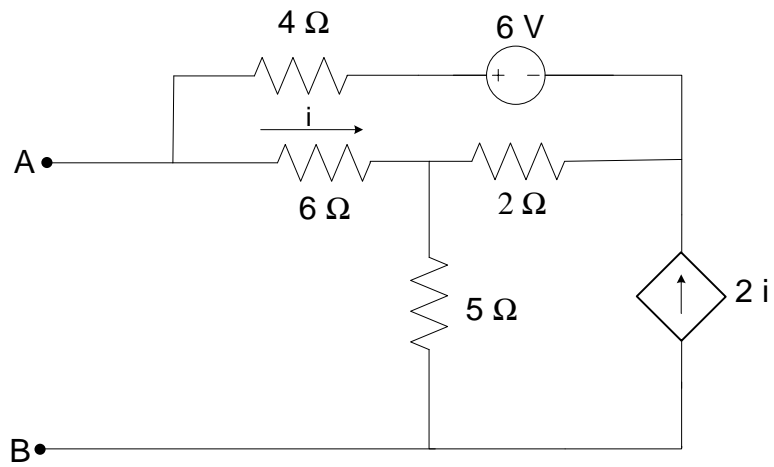


Figure:12

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