0078

National University of Computer and Emerging Sciences
Lahore Campus

Electrical Network Analysis (EE2004)

Final Exam

Date: January 4th, 2025

Course Instructor(s)

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Total Time (Hrs):	3
Total Marks:	100
Total Questions:	5

Roll No   Section   Student Signature

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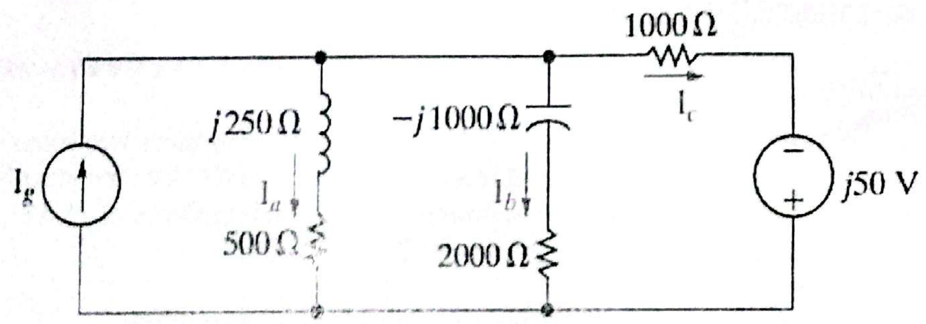
1. **Attempt all the questions. Round off answers to 2 decimal places.**
2. ***Attempt all parts of the same question together.***
3. ***Show all the steps with proper labelled circuit diagrams, direct answers are not acceptable.***
4. ***Attempt each question only ONCE.***

CLO #1: **Apply phasor-domain analysis to solve circuits containing R, L, C, and mutual inductance**

Q1: **[13 + 7 = 20 marks]**

The phasor current I_b in the circuit shown in figure below is $25\angle 0^\circ$ mA

a) Solve the circuit to calculate I_a, I_c and I_g
b) If $\omega = 1500$ rad/s, determine the steady state expression for above mentioned currents

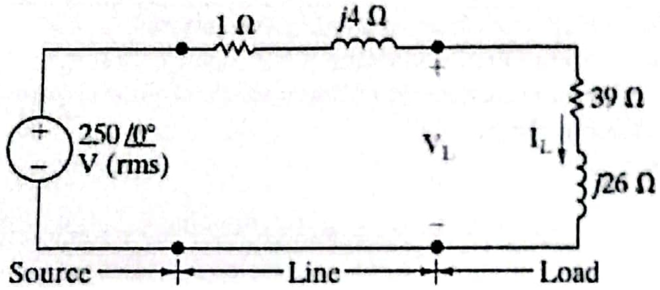


***CLO #2:* Construct power triangle to compute power in AC circuits.**

Q2: **[5 + 5 + 2 + 5 + 3 = 20 marks]**

The load impedance in the circuit shown below is shunted (connected in parallel) by a capacitor having a capacitive reactance of -52Ω, **calculate:**

a) The rms phasor current, I_L and rms phasor voltage, V_L across the load
b) The average power and reactive power absorbed by the (39 + j26 Ω) load. Also, construct its power triangle.
c) The average power and the reactive power dissipated across the line impedance.
d) The complex power delivered by the source. Also, calculate the power factor of the source.
e) The reactive power delivered by the shunting capacitor



***CLO #3:* Analyze balanced three-phase circuits.**

Q3: **[5 + 5 + 5 + 5 = 20 marks]**

A balanced three-phase line has an impedance of 0.1 + j 0.8Ω/Ø. The line feeds two balanced **three-phase loads** connected in parallel. The first load is absorbing a **total** of 630 kW and absorbing 840 kVAR magnetizing vars. The second load is Y-connected and has an impedance of 15.36 – j4.48Ω/Ø. The line to neutral voltage at the load end of the line is $400\angle 0°$ V_{rms}.
Assume positive phase sequence.

a) Construct the single phase equivalent circuit of the system for the a-phase.
b) Calculate the line current, I_{aA}.
c) Calculate the complex power per phase of the second load
d) Calculate the line voltages at the source end, V_{ab}, V_{bc}, V_{ca}

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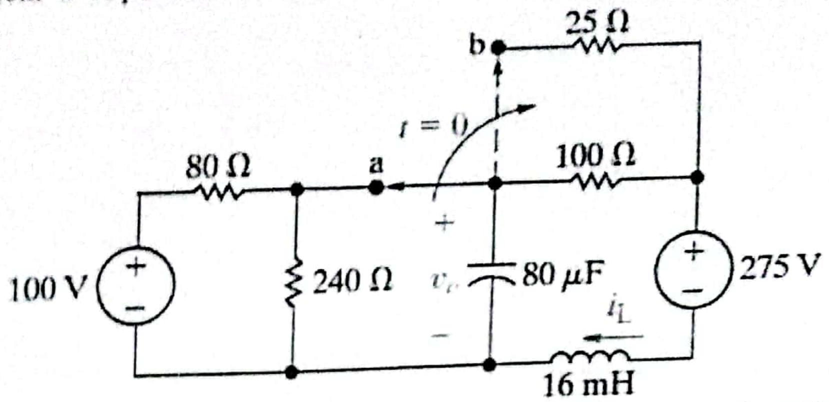
CLO #4: Apply Laplace transform to analyze RLC circuits.

[3 + 4 + 7 + 6 = 20 marks]

Q4:
The switch in the circuit has been at position 'a' for a long time. At $t = 0$, the switch is moved instantaneously from 'a' to position 'b'.

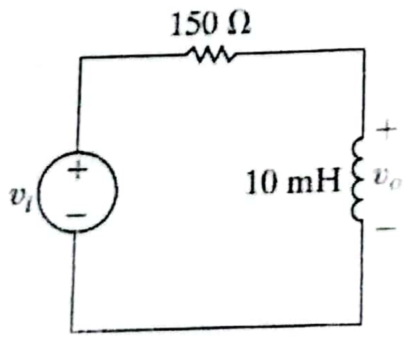


a) Calculate initial voltage across the capacitor, $v_o(0^-)$ and initial current through the inductor, $i_L(0^-)$
b) Transform the given circuit in s-domain
c) Compute the expression for voltage, V_o, and current, I_L, in s-domain
d) Find $v_o(t)$ for $t \geq 0$

CLO #5: Analyze various types of filters using s-domain analytics.

[3 + 6 + 4 + 5 + 2 = 20 marks]

Q5:
For the given filter circuit:



$\frac{R/L}{s+\frac{R}{L}}$

a) Perform qualitative analysis to determine the type of filter.
b) Determine the magnitude and phase of the transfer function, H(s) for the given filter circuit and plot it.
c) Calculate the cutoff frequency, and the magnitude of the filter's transfer function at this cutoff frequency.
d) Suppose a 150 load resistor is attached to the filter (connected in parallel to the inductor) in the circuit above, determine the transfer function and cutoff frequency for this new filter.
e) Compare the gain and cutoff frequency of the loaded filter with the unloaded filter?

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