UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
JANUARY 2016 SESSION

SUBJECT CODE	:	LEB 20903
SUBJECT TITLE	:	NETWORK ANALYSIS
LEVEL	:	DEGREE
TIME / DURATION	:	3 HOURS
DATE	:	

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of 5 Questions. **Answer Four (4) Questions ONLY.**
6. Answer all questions in English.

THERE ARE 9 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

INSTRUCTION: Answer 4 questions ONLY

Please use the answer booklet provided.

Question 1

a)

(i) Describe two (2) advantages of phasor representation.

(2 marks)

(ii) Describe rms magnitude and radian frequency.

(1 mark)

(iii) **Figure 1** shows an RLC circuit. Analyze the circuit and evaluate the current through inductance L2 using Superposition Theorem.

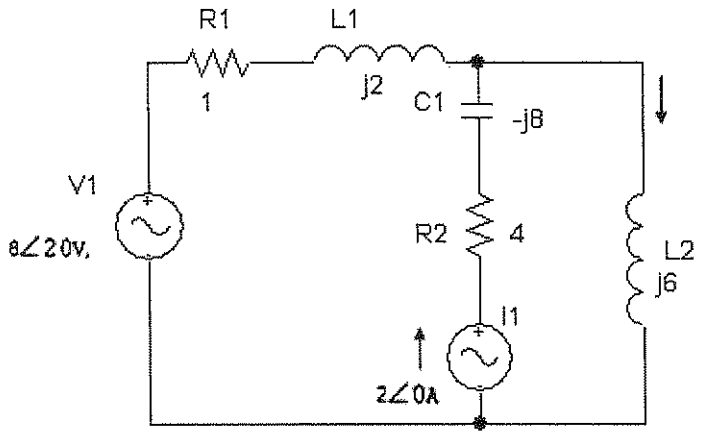

Figure 1

(15 marks)

(CLO 1, CLO 2)

b) (i) The phasor representing the voltage at X in **Figure 2** has the value 50j. Components are labelled with their complex impedances and x(t) has a frequency of ω . Calculate the phasor representing the voltage at Y. (2 marks)

(ii) Express the waveform at Y in the form $y(t) = A\cos(\omega t) + B\sin(\omega t)$.

(3 marks)

(iii) If $\omega = 300$rad/s, calculate the value of the inductance in Henries

(2 marks)

(CLO 1, CLO 2)

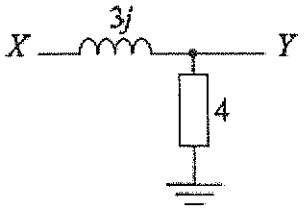

Figure 2

Question 2

a) Based on the circuit in **Figure 3**, determine the load impedance (Z_L) that will absorb the maximum average power and calculate the maximum average power transferred from the source to the load Z_L.

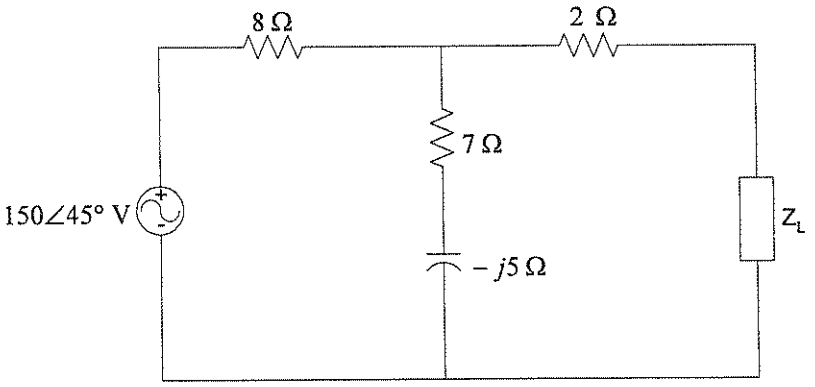

Figure 3

(10 marks)

(CLO 2, CLO 3)

b) As shown in **Figure 4**, a 550-V feeder line supplies an industrial plant consisting of a motor drawing 60 kW at 0.75 pf (inductive), a capacitor with a rating of 20 kVAR, and lighting drawing 20 kW.

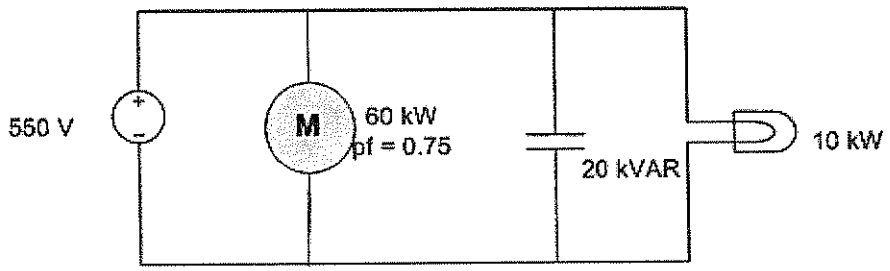

Figure 4

(i) Calculate the total reactive power and apparent power absorbed by the plant.

(ii) Determine the overall pf.

(iii) Find the current in the feeder line.

(10 marks)

(CLO 2, CLO 3)

c) Elaborate why TNB will impose the customer with power factor surcharge when our power factor is less than **0.90** (electricity supply 132kV and above) or less than **0.85** (electricity supply below 132 kV).

(5 marks)

(CLO 3)

Question 3

a) Describe the coefficient of coupling (K) and mutual inductance (M)

(5 marks)

b) Describe the dot rules for dot determination.

(5 marks)

c) **Figure 5** shows a circuit with mutual inductance. Analyze the circuit and evaluate:

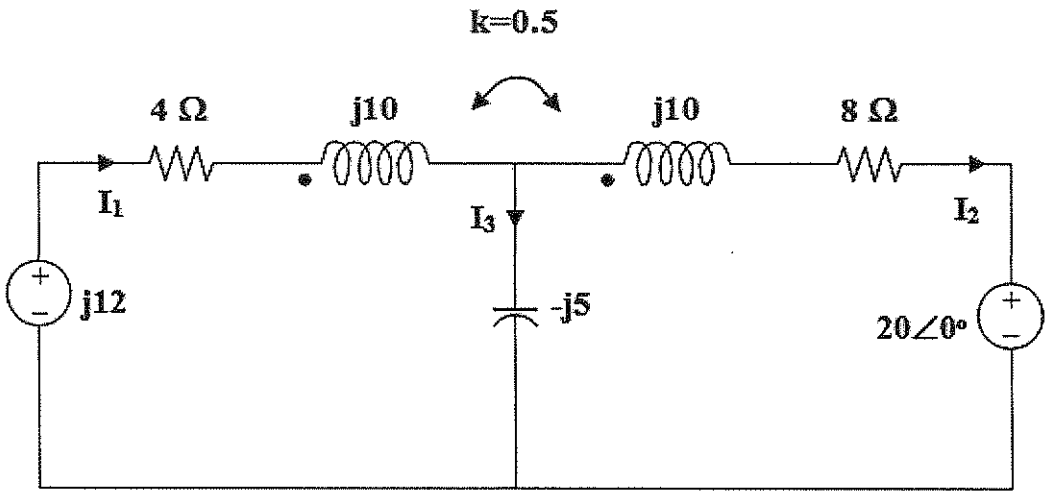

Figure 5

(i) Determine currents I_1, I_2, and I_3 (9 marks)

(ii) Find the energy stored in the coupled coils at $t = 2$ ms. Take $\omega = 1000$ rad/s.

(6 marks)

(CLO 2, CLO 4)

Question 4

a) Explain a two-port network with an example.

(4 marks)
(CLO 5)

b) Analyze the circuit and evaluate the Y parameters for **Figure 6**.

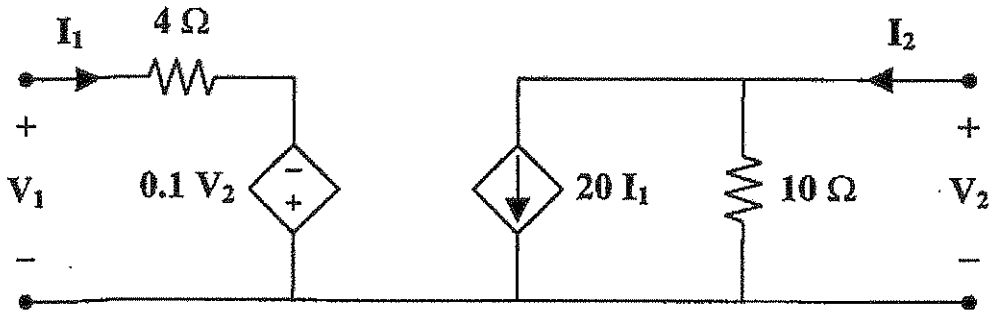

Figure 6

(7 marks)
(CLO 5)

c) **Figure** 7 shows a circuit of two port network. Analyze the circuit and obtain the ABCD parameters for this network .

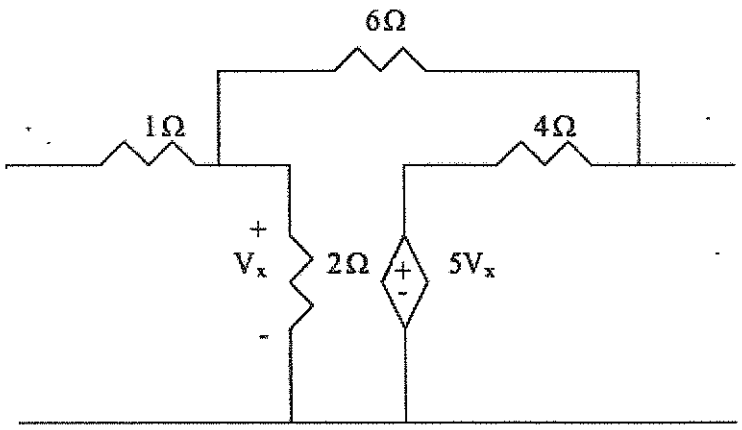

Figure 7

(14 marks)
(CLO 5)

Question 5

a) The **Figure 8** shows, the simple circuit consists of current source and several passive elements.

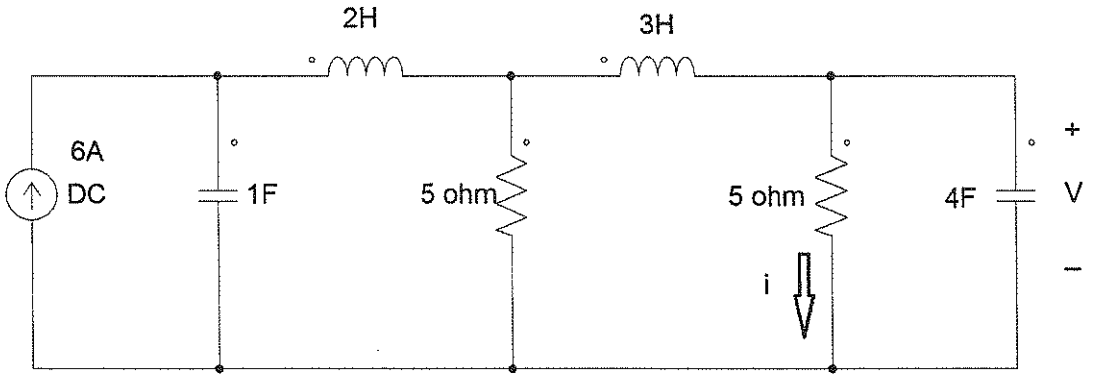

Figure 8

(i) Write the two expressions, one relating voltage $V_L(t)$ and current $i_L(t)$ for an inductor and the other relating voltage $V_c(t)$ and current $i_c(t)$ for a capacitor. (2 marks)

(ii) Hence otherwise, obtain the circuit models for the inductor and for the capacitor that are appropriate for DC steady-state analysis of a circuit containing these elements. (3 marks)

(iii) Use the DC steady state models for the inductor and for the capacitor in order to carry out DC steady-state analysis on the circuit in **Figure 8** in order to find the values of the voltage v and current i. (3 marks)

(CLO 2, CLO 3)

b) Using nodal analysis calculate the voltages at nodes X and Y in **Figure 9**.

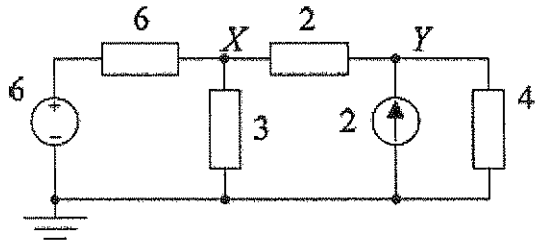

Figure 9

(5 marks)
(CLO 1, CLO 2)

c) The circuit of **Figure 10** represents a voltage source driving a load of $Z_L = (6+8j)\Omega$ via a line having impedance $(1.2+1.6j)\Omega$. The supply voltage is 240 V_{rms} at 50 Hz and is represented by the r.m.s phasor $\tilde{X} = 240$.

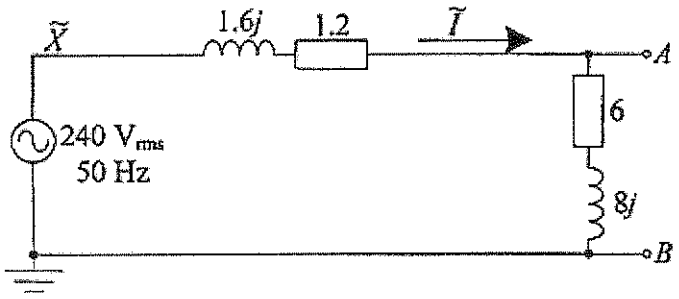

Figure 10

(i) Calculate the current in the circuit, $\tilde{I}$ as an r.m.s phasor and hence calculate the average power absorbed by the line and by the load. (3 marks)

(ii) Determine whether the current lags or leads the supply voltage and the phase angle between them. (3 marks)

(iii) Calculate the admittance, $\frac{1}{Z_L}$, of the load and hence determine the value of capacitor (in farads) that should be placed between terminal A and B so that combination of the load and capacitor purely resistive. (3 marks)

(iv) With the capacitor in place, calculate the current now supplied by the voltage Source and the average power dissipated in the line. (3 marks)

(CLO 1, CLO 2)

END OF QUESTION PAPER