UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE	: LEB 10503
COURSE NAME	: ELECTRIC CIRCUITS
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: BACHELOR OF ENGINEERING TECHNOLOGY (HONS) IN MARINE ELECTRICAL & ELECTRONIC
DATE	: 25TH MAY 2016
TIME	: 2.00 PM – 5.00 PM
DURATION	: 3 HOURS

INSTRUCTIONS TO CANDIDATES

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

THERE ARE 4 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

INSTRUCTION: Answer only FOUR questions.
Please use the answer booklet provided.

Question 1 (CLO2)

(a) The variable resistor R in Figure 1 is adjusted until it absorbs the maximum power from the circuit. Define and examine the maximum power absorbed by R.

(14 marks)

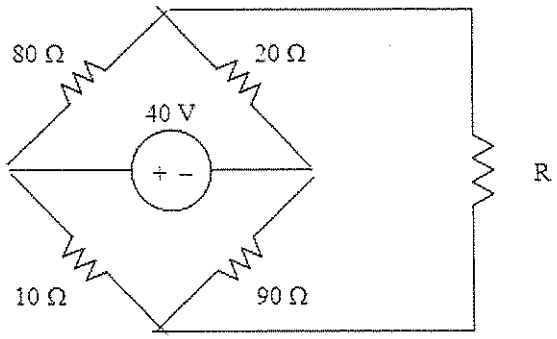

Figure 1

(b) Analyze the circuit shown in Figure 2 to find the Norton equivalent at a-b terminal.

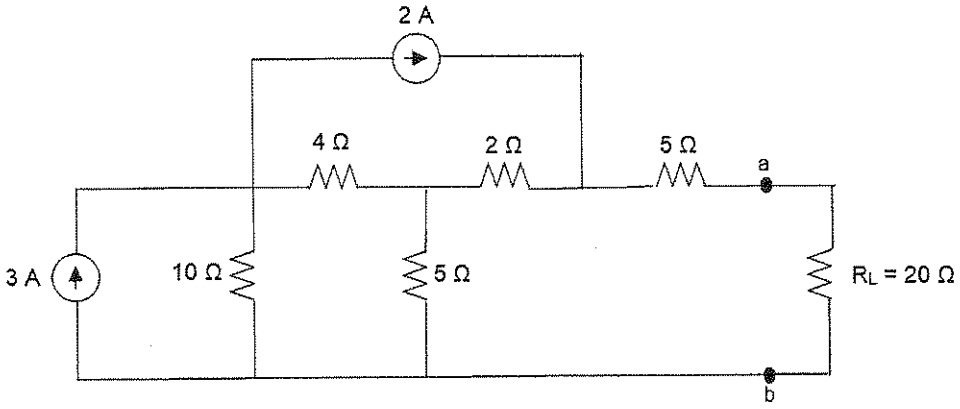

Figure 2

[11 marks]

Question 2 (CLO2)

(a) A factory has the following four major loads:

- A motor rated at 5 hp, 0.8 pf lagging (1 hp = 0.7457 kW)
- A heater rated at 1.2 kW, 1.0 pf.
- Ten 120 –W lightbulbs.
- A synchronous motor rated at 1.6 kVAR, 0.6 pf leading.

i. Calculate the total real and reactive power. (12 marks)

ii. Find the overall power factor. (2 marks)

(b) A 1-MVA substation operates at full load at 0.7 power factor lagging. It is desired to improve the power factor to 0.95 lagging by installing capacitors. Assume that new substation and distribution facilities cost RM120 per KVA installed, and capacitors cost RM30 per KVA installed.

i. Calculate the cost of capacitors needed. (7 marks)

ii. Find the savings in substation capacity released. (2 marks)

iii. Are capacitors economical for releasing the amount of substation capacity? (2 marks)

Question 3 (CLO2)

(a) Explain the steps to determine Node voltages.

(5 marks)

(b) Analyze the circuit of Figure 3 below using the superposition principle to determine the value of i_o.

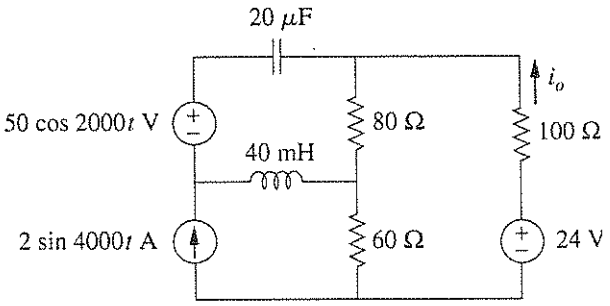

Figure 3

(20 marks)

Question 4 (CLO2)

(a) A three-phase, 50 kW, 415 V, 50 Hz induction motor operates on full load with an efficiency of 100% and a power factor of 0.85 leading. Calculate the total KVAR of capacitor required to raise the full-load power factor to 0.95 leading. What is the required inductance per phase if the inductors are connected in star?

(10 marks)

(b) Solve the circuit in Figure 4 below to find the node voltages by using nodal analysis.

(8 marks)

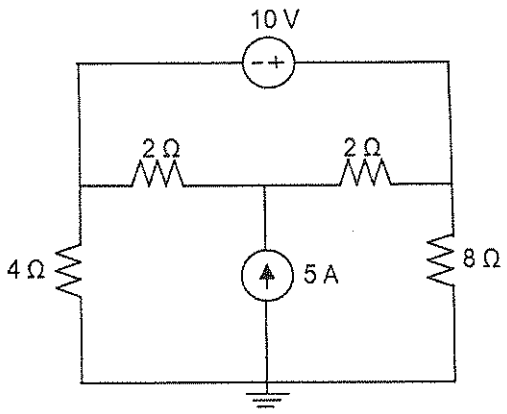

Figure 4

(c) Determine the power factor of the entire circuit in Figure 5 as seen by the source.

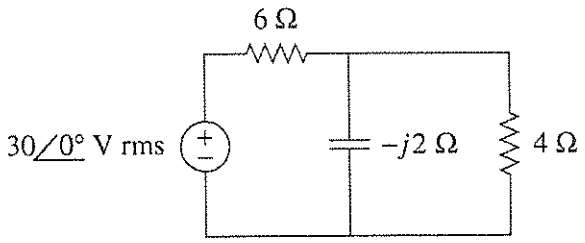

Figure 5

(7 marks)

Question 5 (CLO2)

(a) Two balanced loads are connected to a 240-kV rms 60-Hz line, as shown in Figure 6 below. Load 1 draws 30 kW at a power factor of 0.6 lagging, while load 2 draws 45 kVAR at a power factor 0.8 lagging. Assuming the positive sequence, determine:

i. The complex power, real power, reactive powers and power factor for the combined load

(8 marks)

ii. The line currents, (6 marks)

iii. The KVAR rating of the three capacitors delta-connected in parallel with the load that will raise the power factor to 0.9 lagging and the capacitance of each capacitor (4 marks)

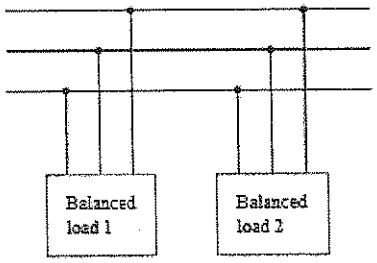

Figure 6: The original balanced loads

(b) A balanced delta-connected source has a line current of $I_{L1} = 1.5\ \angle 0^0$A and a positive phase sequence. If this source is connected to a balanced wye-connected load with the load impedance per phase is a 50-j20 Ω, determine the currents and voltages in the load and the magnitude of the line voltages.

(7 marks)

END OF QUESTIONS