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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2014 SESSION

SUBJECT CODE	:	**FED 10203**
SUBJECT TITLE	:	**ELECTRICAL TECHNOLOGY**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**2.5 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. **Answers should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) question only.**
6. **Answer all questions in English.**

THERE ARE 6 PAGES OF QUESTIONS AND 1 PAGE OF FORMULAE, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL question.
Please use the answer booklet provided.

Question 1

(a) **Explain** a phase relationship between the sinusoidal waveforms of the following set.

$i(t) = 5 \sin(377t - 30°)$ A

$v(t) = 10 \cos(377t + 80°)$ V

(4 marks)

(b) Referring to the Sinusoidal voltage waveform shown in the **Figure** 1 below, determine:

(10 marks)

(i) Peak voltage, V_P

(ii) Peak to peak voltage, V_{pp}

(iii) RMS Voltage (effective value), V_{rms}

(iv) Average voltage, V_{AV}

(v) Define period of a sine wave.

(vi) Define frequency of a sine wave.

(vii) Instantaneous voltage at ***1ms***

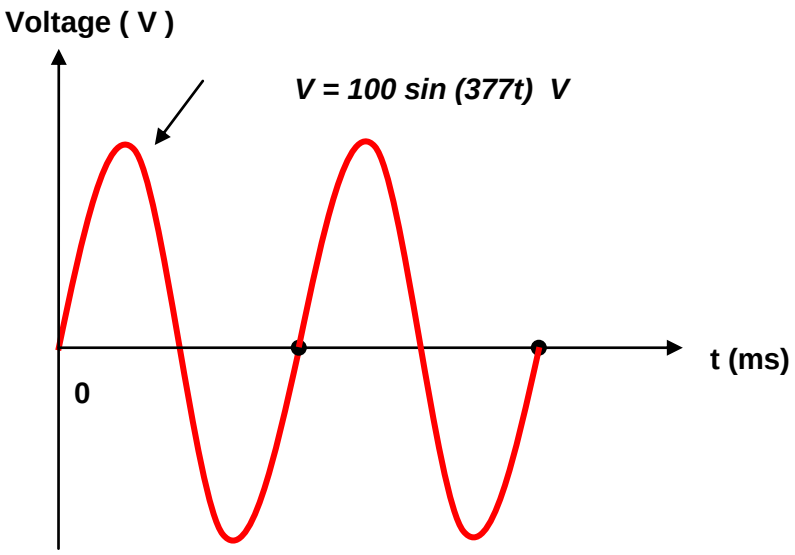

Figure 1

(c) In the circuit shown in **Figure 2**, determine the value of the inductance (*L*) in resonance with the source voltage $v_s(t)$ = 13 cos (600*t* + 85°) V

(6 marks)

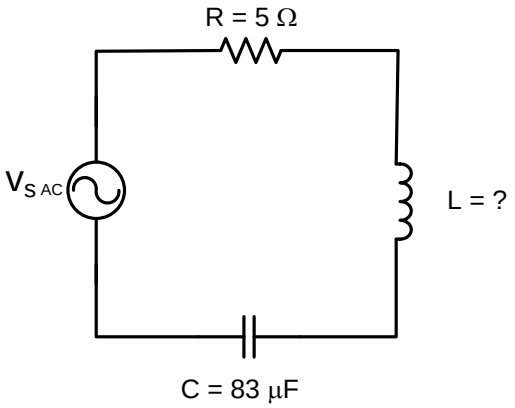

Figure 2

Question 2

Analyze the series - parallel AC network in **Figure 3**:

(a) Find $\mathbf{Z_T}$

(14 marks)

(b) Determine the current $\mathbf{I_T}$ and $\mathbf{I_2}$

(6 marks)

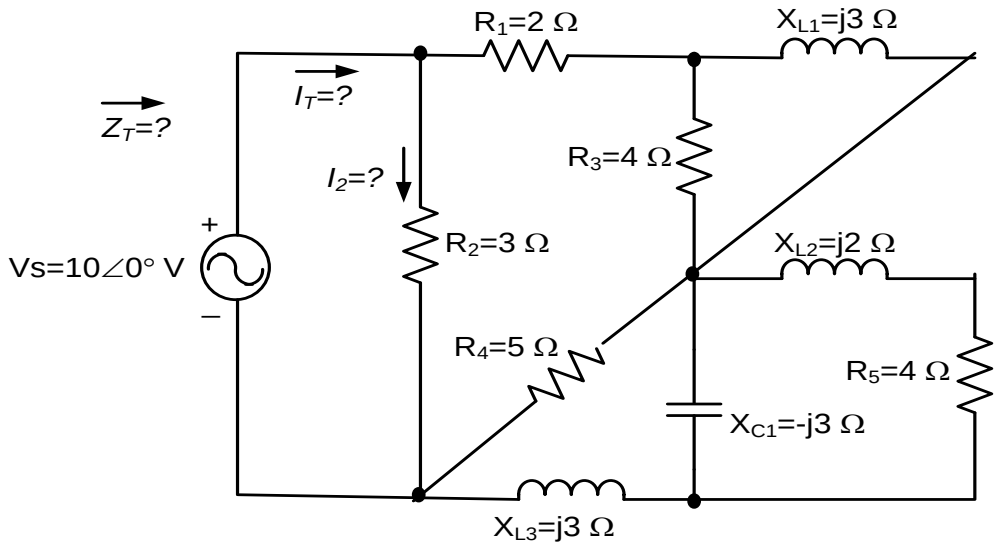

Figure 3

Question 3

Three (3) loads are connected in parallel to a 3 kV_{RMS} AC line, as shown in **Figure 4**. Given;

P_1 = 5 kW, PF_1 = 1

P_2 = 12 kW, PF_2 = 0.75 lagging

P_3 = 8.5 kW, PF_3 = 0.63 lagging

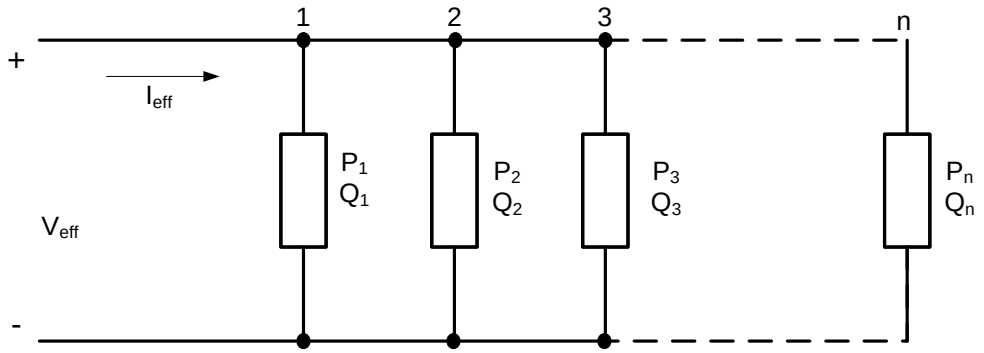

Figure 4

Find :

(a) Active power total (P_T)

(3 marks)

(b) Reactive power total (Q_T)

(3 marks)

(c) Apparent power total (S_T)

(3 marks)

(d) Power factor total (cos θ)

(3 marks)

(e) Current (I_{RMS})

(3 marks)

(f) A fourth load Q_4 is added in parallel to the three parallel loads as in **Figure 4**, such that the total power factor becomes 0.9 lagging while the total power remains the same. Find Q_4 and the resulting S (New Apparent power)

(5 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.
Please use the answer booklet provided.

Question 4

Calculate the value of voltage V_0 in the circuit shown in **Figure 5**, by using :

(a) Nodal's analysis

(10 marks)

(b) Superposition's theorem.

(10 marks)

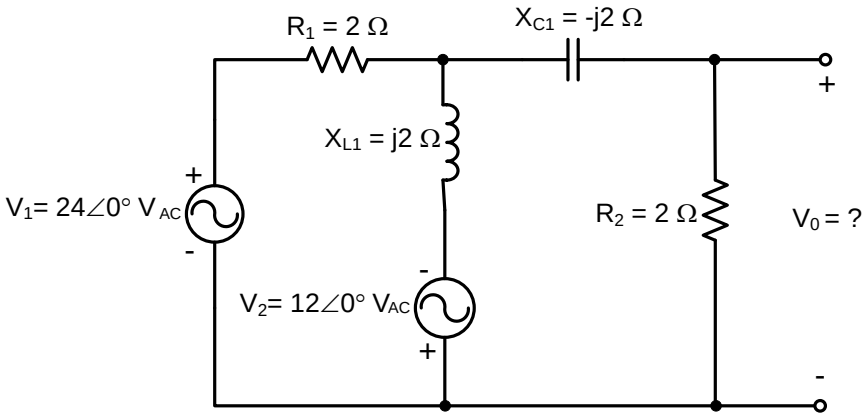

Figure 5

Question 5

(a) Plastic kayaks are manufactured using a process called rotomolding which is diagrammed in **Figure 6**. Molten plastic is injected into a mold, which is then spun on the long axis of the kayak until the plastic cools, resulting in a hollow one piece craft. Suppose that induction motors used to spin the molds consume 50 kW at a power factor (pf = cos θ) of 0.8 lagging from a $220\angle 0°\ V_{RMS}$, 60 Hz line. We wish to raise the pf to 0.95 lagging by placing a bank of capacitors in parallel with the load. Determine the value of that capacitor.

(10 marks)

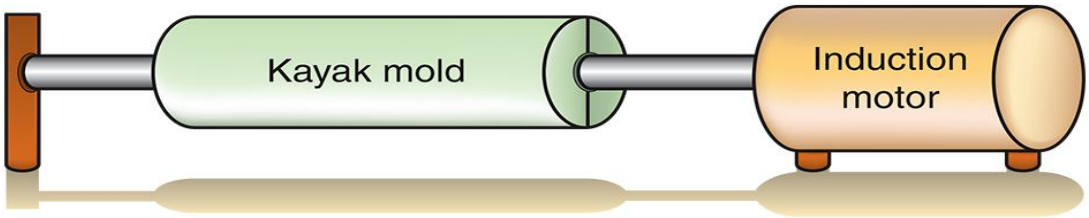

Figure 6 : Rotomolding process

(b) An industrial load as in **Figure 7** requires 40 kW at power factor 0.84 lagging. The load voltage is $220\ \angle 0°\ V_{RMS}$ at 60 Hz. The transmission line impedance is 0.1 + j0.25 Ω. Determine :

(i) The active (P) and reactive (Q) power losses in the line.

(5 marks)

(ii) The active (P) and reactive (Q) power required at the input to the transmission line.

(5 marks)

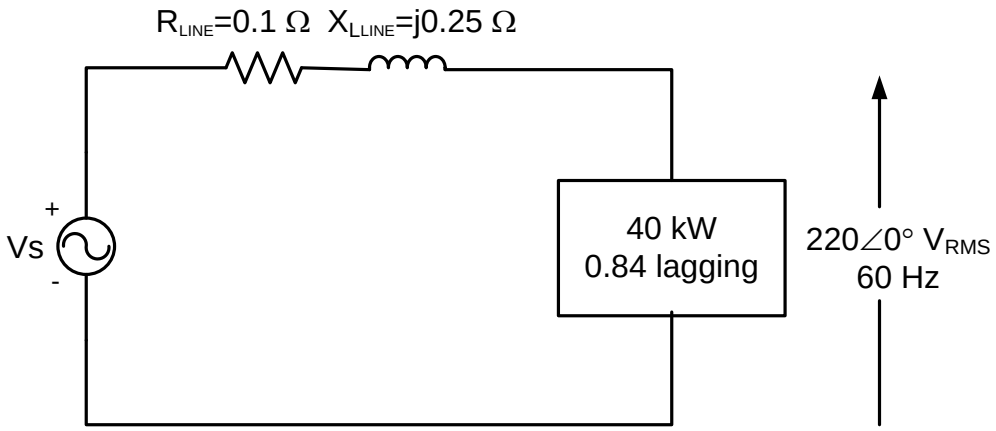

Figure 7

Question 6

(a) Refer to **Figure 8**, compute the magnitude of the line voltage at the load :

(i) V_{AB}

(ii) V_{BC}

(iii) V_{CA}

(9 marks)

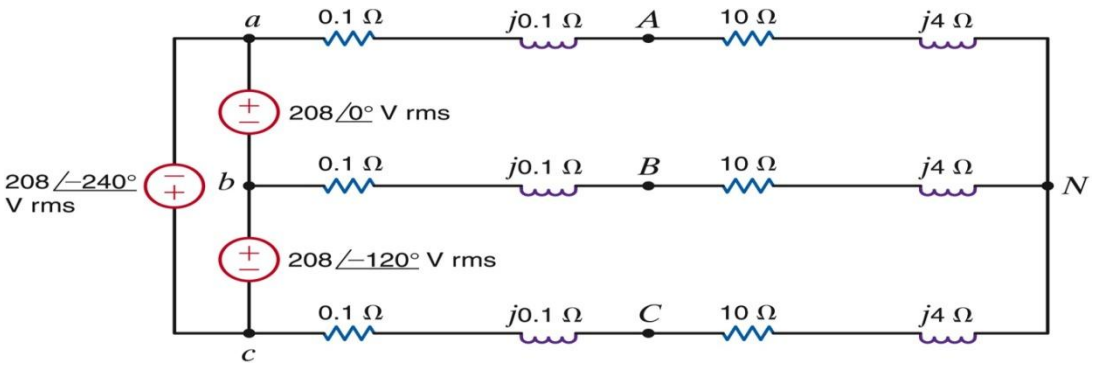

Figure 8

(b) Calculate a three phase Star – Delta system as shown in **Figure 9**.

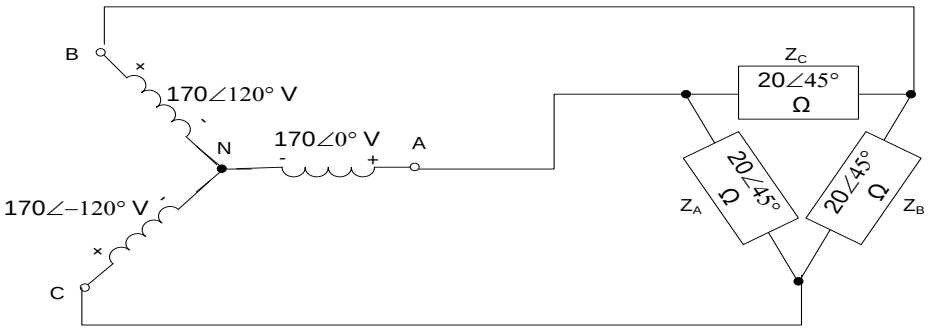

Figure 9

(i) Find the line voltages.

(3 marks)

(ii) Find the load currents.

(3 marks)

(iii) Find the line currents.

(3 marks)

(iv) Determine the phase angle between a **line voltage** and a **line current.**

(2 marks)

END OF QUESTION PAPER

FORMULAE

$f = \frac{1}{T}$ Hz

$\omega = 2\pi f$ rad/sec

$Z_R = R\angle 0° \ \Omega$

$Z_L = jX_L = jL\omega = L\omega \angle 90° \ \Omega$

$Z_C = -jX_C = \frac{1}{jC\omega} = \frac{1}{C\omega}\angle -90° \ \Omega$

Series circuit : $Z_T = Z_1 + Z_2 + Z_3 + \ldots\ldots + Z_N \ \Omega$

Parallel circuit : $\frac{1}{Z_T} = \frac{1}{Z_1} + \frac{1}{Z_2} + \frac{1}{Z_3} + \ldots\ldots + \frac{1}{Z_N} \ \Omega$