UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
JANUARY 2016 SESSION

SUBJECT CODE	:	**LEB 20503**
SUBJECT TITLE	:	**ELECTRO-TECHNIQUE 1**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**2.00 PM – 5.00 PM / 3 HOURS**
DATE	:	**23 MEI 2016**

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 TWO (2) sections; Section 'A' and Section 'B'. Answer **ALL** questions in Section 'A' and **THREE (3)** questions only from Section 'B'.
6. Answer all questions in English.

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

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

Question 1 [CLO1,2,5]

a) Motors convert electrical energy to mechanical motion by taking advantage of the force produced when a current – carrying conductor is in a magnetic field. Describe clearly four classification of DC motor.

[4 marks]

b) Calculate the voltage induced in the armature winding of a 4 pole, lap wounding, DC machine having 728 active conductors and running at 1800 rpm. The flux per pole is 30mWb [3 marks]

c) A DC series motor is running with a speed of 800 r/min while taking a current of 20 A from the supply. If the load is changed such that the current drawn by the motor is increased to 50 A. Calculate the speed of the motor on new load. The armature and series field winding resistances are 0.2 Ω and 0.3 Ω respectively. Assume the flux produced is proportional to the current. Assume supply voltage as 250 V.

[8 marks]

d) Determine the phase relationship between the following waveforms. Sketch and labels completely:

I) $i = 20 \sin(\omega t + 800)$ II) $i = 10 \cos(\omega t - 250)$

$V = 10 \sin(\omega t - 500)$ $V = 6 \sin(\omega t - 300)$ [5 marks]

Question 2 [CLO 1,2,4,5]

a) There are three type of power in AC circuit which are average power P, apparent Power S and reactive power Q. Describe clearly the different among **three types** of power system. What does it means by **positive power** and **negative power.**

[5 marks]

b) For a series AC circuits with reactive elements depending on the frequency applied, the same circuit can be either predominantly inductive or predominantly capacitive. Define parallel and series impedances and analyze AC circuits using circuit techniques based on the Figure 1.

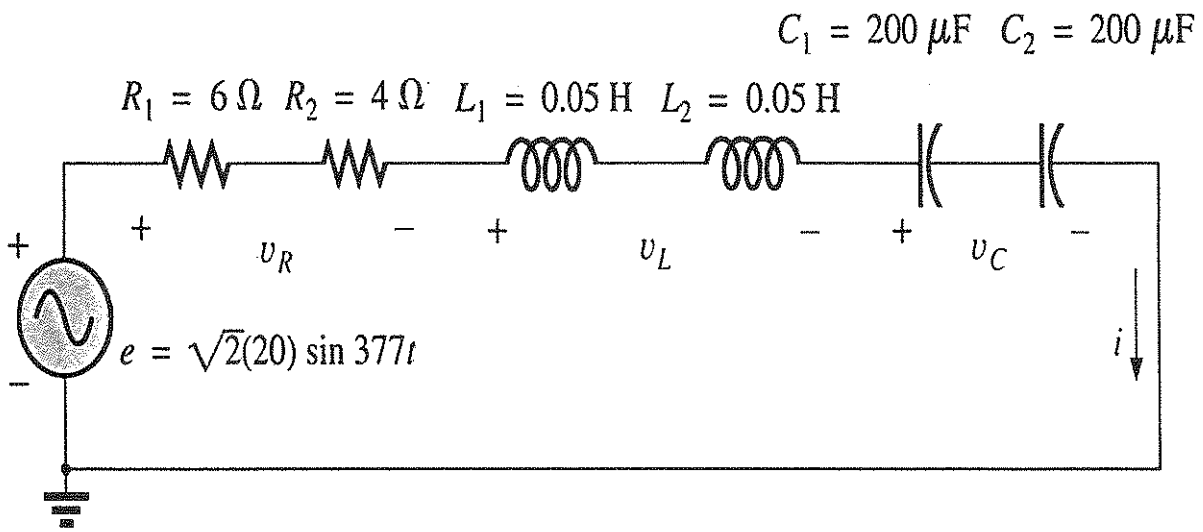

Figure 1

Determine:

i. the total impedance
ii. Calculate the total current
iii. Calculate VR, VL and VC
iv. Calculate the total power factor
v. Calculate the average power delivered to the circuit
vi. Draw the phasor diagram
vii. Obtain the phasor sum of VR, VL and VC and show that it equals the input voltage E.
viii. Find VR and VC using divider voltage rule.

[15 marks]

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) question only.
Please use the answer booklet provided.

Question 3 [CLO 1,4,5,6]

a) Alternating signal is a signal that varies with respect to time. Alternating signal can be categories into ac voltage and ac current. This voltage and current have positive and negative value. Sketch and label the complete sinusoidal waveform which include all the followings criteria: [v = 8V]

i. period
ii. peak value
iii. peak to peak value
iv. instantaneous value
v. average value [6 marks]

b) The total number of watts, volt-amperes reactive, and volt-amperes, and the power factor F_p of the AC circuit can be found through the Figure 2.

i) Find the total number of watts P_T, volt-amperes reactive Q_T, and volt-amperes S_T and draw the power triangle. [7 marks]

ii) Find the power factor F_p [2 marks]

iii) Find the current in phasor form [5 marks]

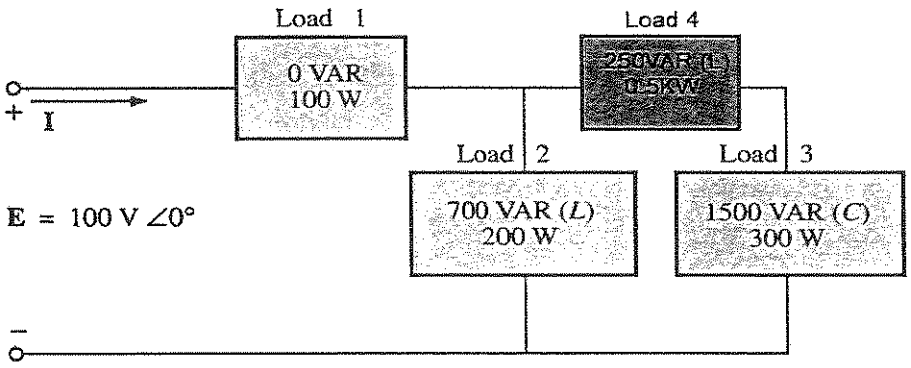

Figure 2

Questions 4 [CLO 2, 4, 6]

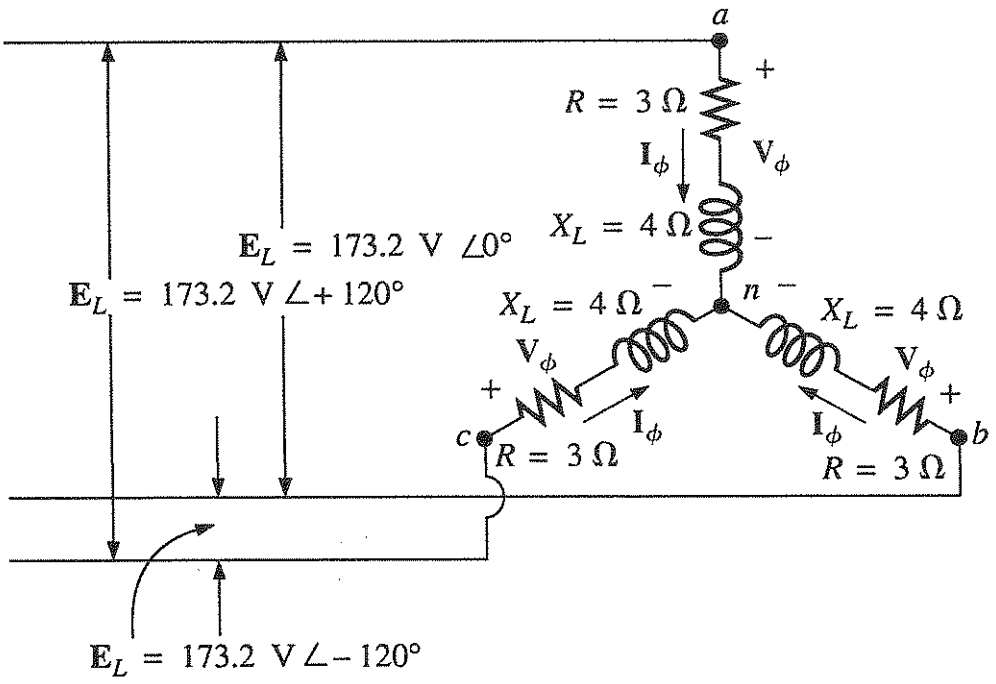

Figure 3

a) For the Y-connected load in Figure 3;

i. find the average power to each phase and the total load

ii. determine the reactive power to each phase and the total reactive power

iii. find the apparent power to each phase and the total apparent power

iv. find the power factor of the load [10 marks]

b) Describe how an alternator generates electricity. [3 marks]

c) Assume a large alternator is turned by a turbine at 300 rpm and has 24 poles. What is the output frequency and at what speed must the rotor move to produce a 50Hz output?

[7 marks]

Question 5 [CLO 4,5,6]

a) Draw a delta circuit and write the formulas for delta to wye conversion

[4 marks]

b) A balanced delta connected load having an impedance 20 - j15 Ω is connected to a delta connected, positive sequence generator having V_{AB} = 330∠0° V. Calculate the phase currents of the load and the line currents as shown in Figure 4.

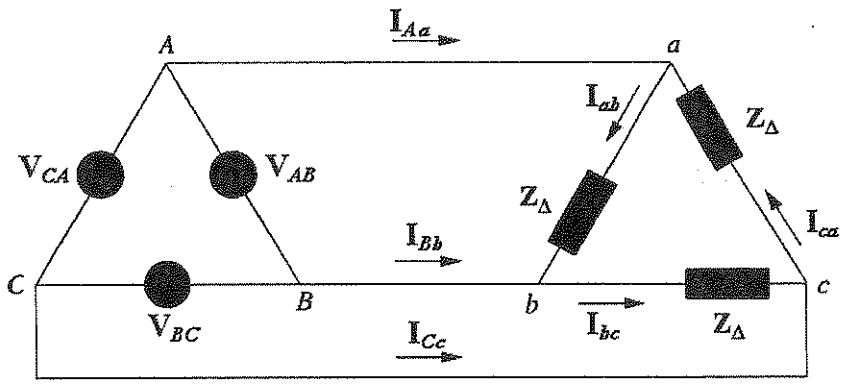

Figure 4

[8 marks]

c) A balanced Y-connected load with a phase impedance 40 + j25 Ω is supplied by a balanced, positive-sequence Δ-connected source with a line voltage of 210 V. Calculate the phase currents. Use VAB as reference in Figure 5.

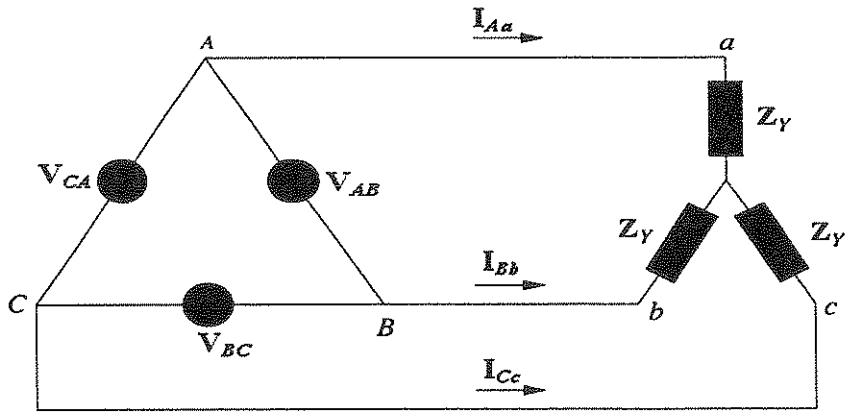

Figure 5 [8 marks]

Question 6 [CLO 1,2,4,5,]

a) Each transmission line of the three-wire, three-phase system has an impedance of 15 Ω + j 20 Ω. The system delivers a total power of 160 kW at 12,000 V to a balanced three-phase load with a lagging power factor of 0.86 is as shown in Figure 6.

i. Determine the magnitude of the line voltage EAB of the generator.

ii. Find the power factor of the total load applied to the generator.

iii. What is the efficiency of the system?

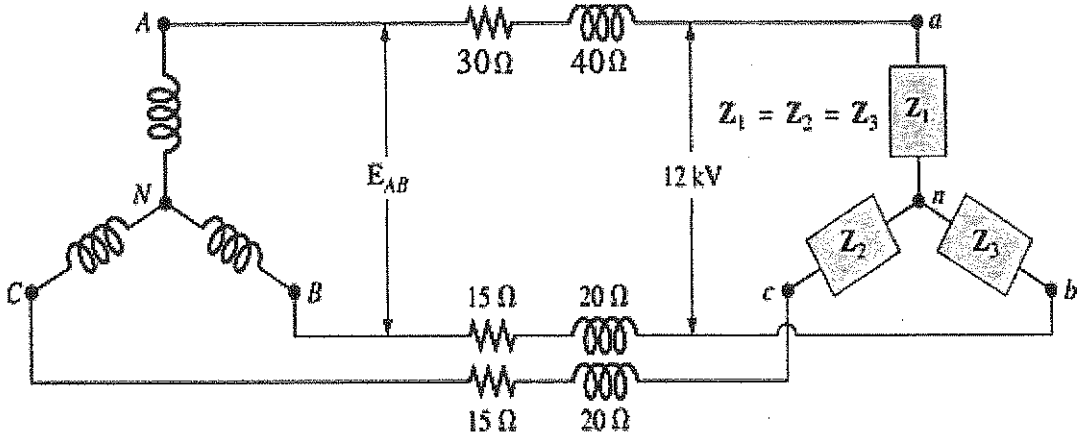

Figure 6 [12 marks]

b) A 250 V, DC shunt motor takes a line current of 20 A. Resistance of shunt field winding is 200 Ω and resistance of the armature is 0.3 Ω. Find the armature current, I_A and the back e.m.f., E_A.

[8 marks]

END OF QUESTIONS