UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
SEPTEMBER 2016 SEMESTER

COURSE CODE	:	LEB 20503
COURSE NAME	:	ELECTRO-TECHNIQUE 1
PROGRAMME NAME	:	BACHELOR OF ELECTRICAL & ELECTRONICS
DATE	:	23 JANUARY 2017
TIME	:	09.00 AM – 12.00 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. 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'.
4. Please write your answers on the answer booklet provided.
5. Answer all questions in English language.

THERE ARE 5 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

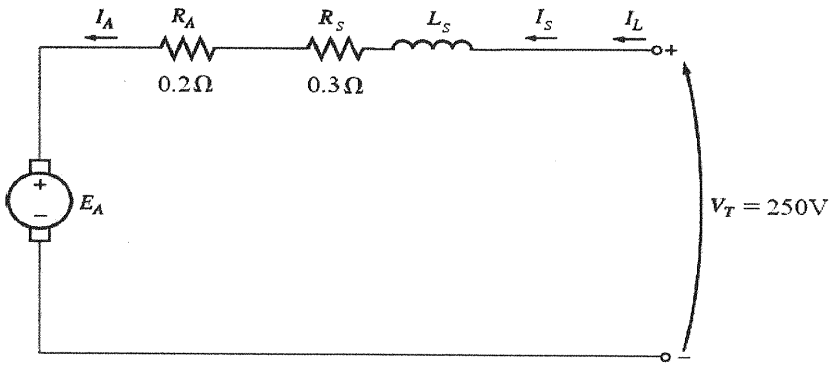
SECTION A (Total: 40 marks)

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

Question 1 [CLO 1]

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. Discuss the basic operation of DC motor. [6 marks]

b) 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 as shown Figure 1.



[8 marks]

Figure 1

c) 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]

Question 2 [CLO 2]

a) 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 series impedances and analyze series AC circuits using circuit techniques based on the following Figure 2. [5 marks]

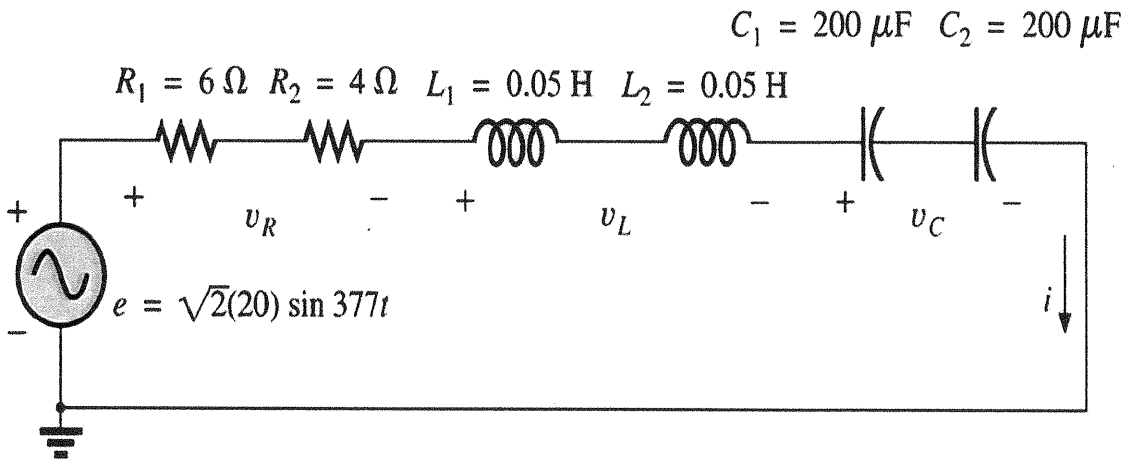


Figure 2

b) Determine:

i. the total impedance

ii. the total current

iii. VR, VL and VC

iv. the total power factor

v. 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 voltage divider rule

[15 marks]

SECTION B (Total: 60 marks)

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

Question 3 [CLO 3]

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.

[3 marks]

b) The current a 0.1 H coil is given by the expression;

$i = 5 \sin (255t - 80^{o})$

Determine the expression for the voltage *v* across the coil and sketch the curves for *v* and *i*.

[8 marks]

c) Two possible configurations in three phase system are star connection and delta connection. Draw the three-phase voltages source for star connection 4 wire and delta connection 3 wire. [3 marks]

d) A balanced delta connected load having an impedance 20 - j15 ohm is connected to a delta connected, positive sequence generator having VAB = 330 $<0^{o}$ V. Calculate the phase currents of the load and the line currents. [6 marks]

Questions 4 [CLO 2]

a) The phase sequence can be determined by the order in which the phasors representing the phase voltages pass through a fixed point on the phasor diagram if the phasors are rotated in a counterclockwise direction. Express line voltage and phase voltage equations in phasor notation. [5 marks]

b) Evaluate the total power (P), reactive power (Q), and complex power (S) at the source and at the load of the following figure 3.

[10 marks]

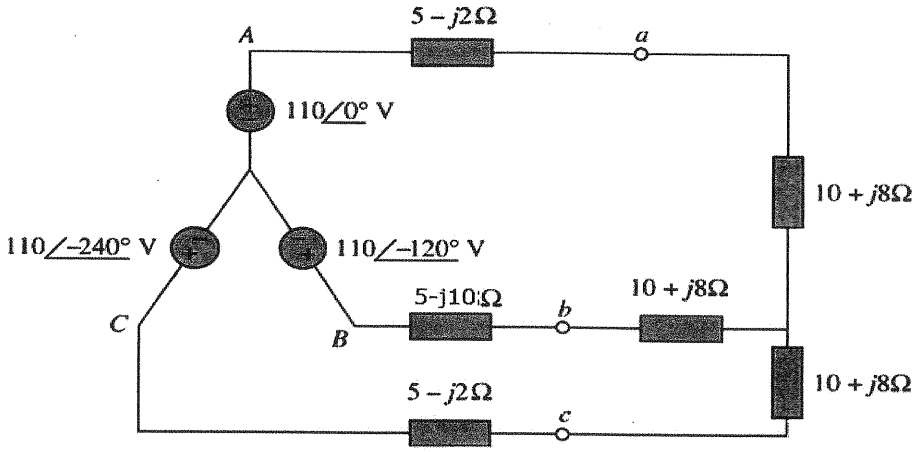


Figure 3

c) A three phase motor can be regarded as a balanced Y-load. A three phase motor draws 5.6 kW when the line voltage is 220 V and the line current is 18.2 A. Determine the power factor of the motor as shown in figure 3.

[5 marks]

Question 5 **[CLO 4]**

a) Each transmission line of the three-wire, three-phase system in the following figure 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 as shown in Figure 4.

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

ii) Calculate the power factor of the total load applied to the generator.

iii) Find the efficiency of the system.

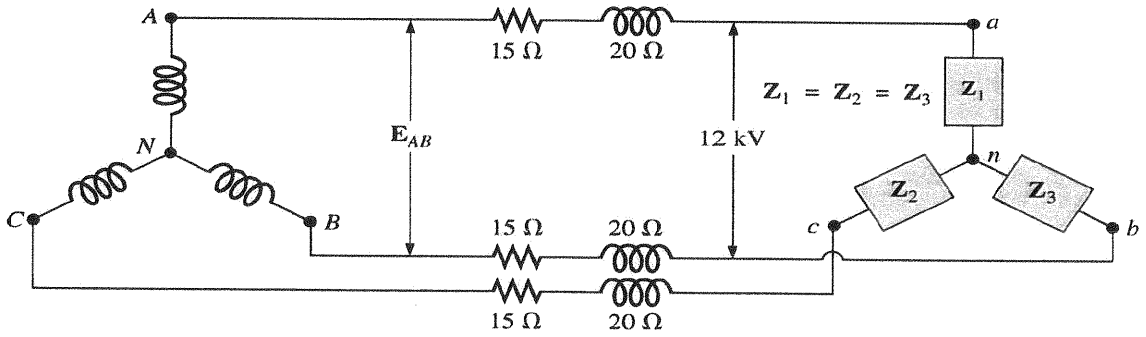


Figure 4

[10 marks]

b) Describe how an alternator generates electricity.

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

[10 mark]

Question 6 [CLO 4]

a) The terms leading and lagging are used to indicate the relationship between two sinusoidal waveforms of the same frequency f (or angular velocity ω) plotted on the same set of axes. Determine the phase relationship between the following waveforms

$i=2\cos(\omega t + 10)$

$V= 3\sin((\omega t - 10)$ [5 marks]

b) A 50hp, 250 V, 1200 r/min dc shunt motor with compensating windings has an armature resistance (including the brushes, compensating windings, and interpoles) of 0.06 Ω. Its field circuit has a total resistance Radj + RF of 50 Ω, which produces a no-load speed of 1200 r/min. There are 1200 turns per pole on the shunt field winding. Find the speed of this motor when its input current is 300 A.

c) The motor then connected in separately excited circuit. The motor is initially running at speed, n = 1103 r/min with VA = 250 V and IA = 120 A, while supplying a constant-torque load. If VA is reduced to 200 V.

Determine i) The internal generated voltage, EA [8 marks]

ii) The final speed of this motor, n2 [7 marks]

END OF QUESTIONS