UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	: ELECTRICAL TECHNOLOGY
COURSE CODE	: BEE 10403/BEE 1223/BEX10303
PROGRAMME	: BEE
EXAMINATION DATE	: JUNE 2012
DURATION	: 2 HOURS 30 MINUTES
INSTRUCTION	: ANSWER **ALL** QUESTIONS IN **PART A** ANSWER **TWO** QUESTIONS IN **PART B**

THIS PAPER CONSISTS OF **EIGHT (8)** PAGES

PART A

Q1 (a) In a linear circuit, the voltage source is

$$v_s = 12\text{Sin}(10^3 t - 24^o)\text{V}$$

(i) What is the angular frequency of the voltage? (1 mark)

(ii) What is the frequency of the source? (1 mark)

(iii) Find the period of the voltage. (1 mark)

(iv) Express v_s in cosine form. (1 mark)

(v) Determine v_s at t = 2.5 ms. (3 marks)

(b) Let $\boldsymbol{X} = 8\angle 40^o$ and $\boldsymbol{Y} = 10\angle -30^o$. Evaluate $(\boldsymbol{X} + \boldsymbol{Y})/\boldsymbol{X}$ and express the result in polar form. (4 marks)

(c) Transform the following sinusoids to phasors.

(i) $-10\text{Cos}(4t + 75^o)$ (2 marks)

(ii) $5\text{Sin}(20t - 10^o)$ (2 marks)

Q2 (a) Name **TWO (2)** differences between time domain, $v(t)$, and phasor domain representation, V, of a signal. (4 marks)

(b) Given the RLC circuit shown in **Figure Q2(b)**, determine the

(i) total load impedance (3 marks)

(ii) current, I, flowing in the circuit (2 marks)

(iii) voltage drop across the inductor, L (4 marks)

(iv) phase angle difference between V_s and I (2 marks)

Q3 A coil of 800 turns is uniformly wound on an iron ring of mean circumference 45 cm and uniform cross-sectional area 5 cm^2, and has a resistance of 25 Ω. The relative permeability of the iron at the working flux density is 800. If the coil is connected to a 20 V d.c supply, identify:

(a) the m.m.f

(3 marks)

(b) the magnetic field strength

(4 marks)

(c) the magnetic flux in the iron

(4 marks)

(d) the reluctance of the iron ring.

(4 marks)

Q4 (a) What is quantization of charge?

(2 marks)

(b) Find the number of electrons that constitute one coulomb.

(2 marks)

(c) Define dielectric constant.

(2 marks)

(d) The plates of a capacitor of capacitance C are charged to a potential V. Write an expression for the energy stored in a capacitor.

(2 marks)

(d) Refer to the circuit shown in **Figure Q4(e)**, determine:

(i) the total capacitance.

(1 mark)

(ii) the voltage across each capacitor

(2 marks)

(ii) the energy in each capacitor.

(4 marks)

PART B

Q5 (a) Mention the difference between the balanced polyphase system and unbalanced polyphase system.

(4 marks)

(b) A balanced 120 V-rms wye-connected three-phase source with positive phase sequence is connected to two balanced three-phase loads connected in parallel. Load #1 is wye-connected with $Z_Y = (30 + j40)\ \Omega$ and Load #2 is delta-connected with $Z_\Delta = (60 - j45)\ \Omega$. The line impedance per phase is $Z_l = (2 + j4)\ \Omega$ as shown in **Figure Q5(b)**. Given the phase angle of line to neutral voltage at the source terminal, V_{an}, is zero, determine:

(i) the total impedance of the circuit

(3 marks)

(ii) the line current, I_a

(3 marks)

(iii) the line-to-neutral voltage across the parallel load, V_{AN}

(4 marks)

(iv) the total real and reactive power drawn from the source

(6 marks)

Q6 (a) Describe the properties of an ideal transformer and draw the elementary model of a transformer.

(5 marks)

(b) An ideal transformer supplies a power of 400 W to a 250 Ω load when the primary winding is connected to a 240 V supply. Determine the:

(i) voltage across the load

(3 marks)

(ii) turns ratio

(3 marks)

(iii) primary current1

(3 marks)

(c) A transformer has a rated output of 200 kVA at a power factor of 0.8. Determine the:

(i) rated power output

(3 marks)

(ii) reactive power.

(3 marks)

Q7 (a) For a DC motor,

(i) Explain a basic DC motor operation for a complete revolution shown in **Figure Q7(a)**

(4 marks)

(ii) List down or draw all of the possible losses in a DC motor

(4 marks)

(iii) Explain the difference between a shunt DC motor and a series DC motor.

(2 marks)

(b) A 200 V shunt DC motor shown in **Figure Q7(b)** has an armature resistance of 0.2 Ω and a field resistance of 100 Ω. During no load, the line current draws 5.0 A while the motor is running at 2000 rpm.

(i) At full load, the line current is 40 A, calculate the full load speed.

(5 marks)

(ii) At full load condition, if the field resistance is increased to 150 Ω, calculate the new full load speed. Assume the line current has not changed.

(5 marks)

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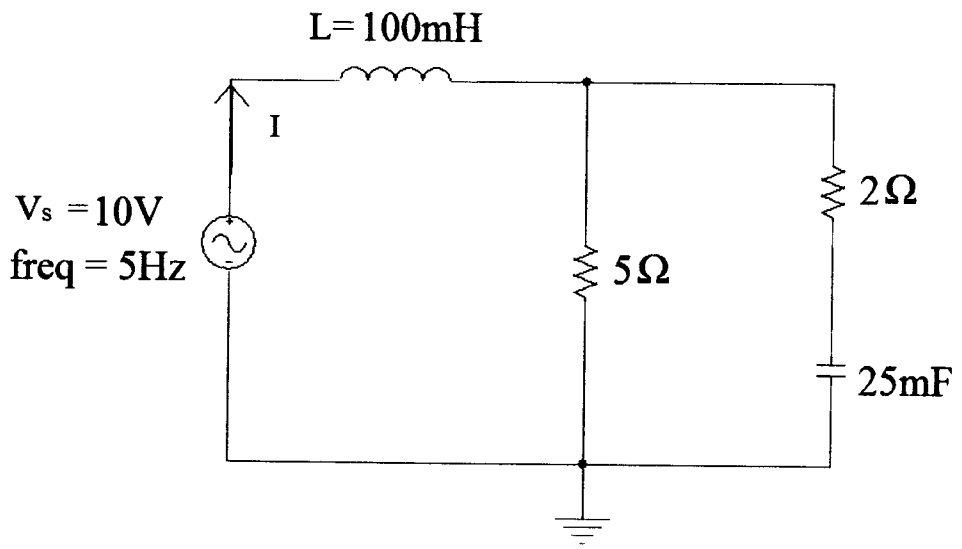

FIGURE Q2(b)

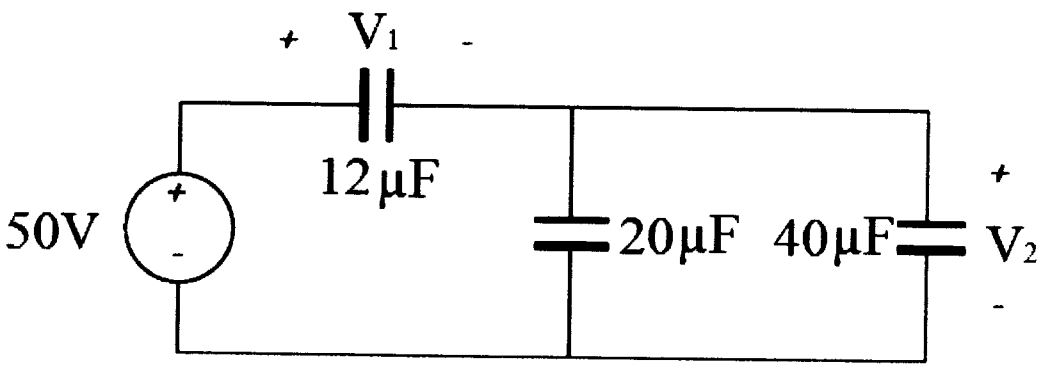

FIGURE Q4(e)

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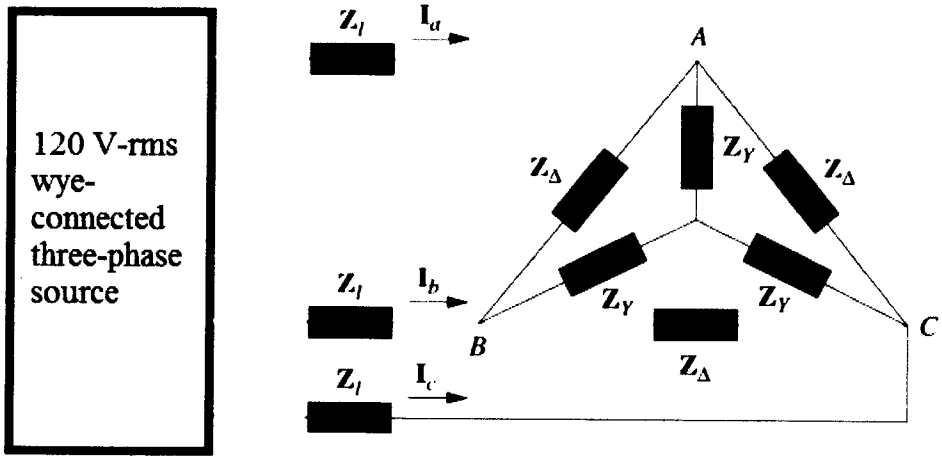

FIGURE Q5(b)

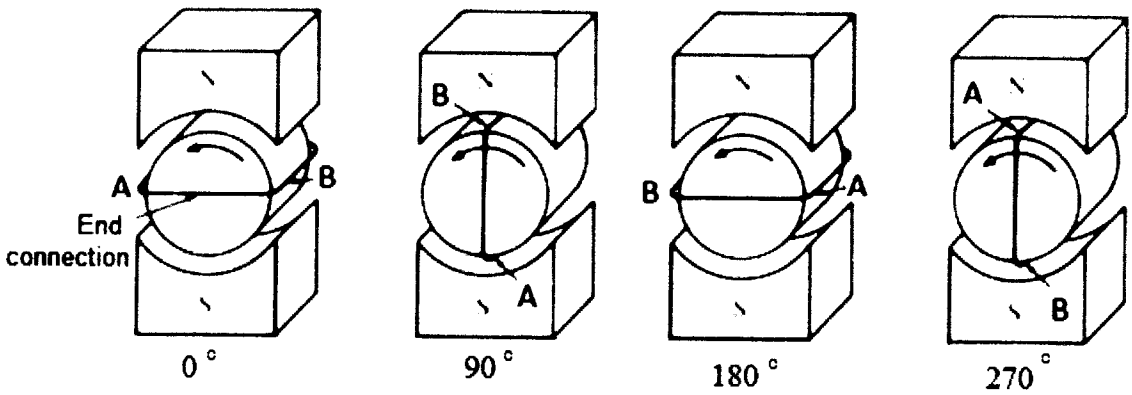

FIGURE Q7(a)

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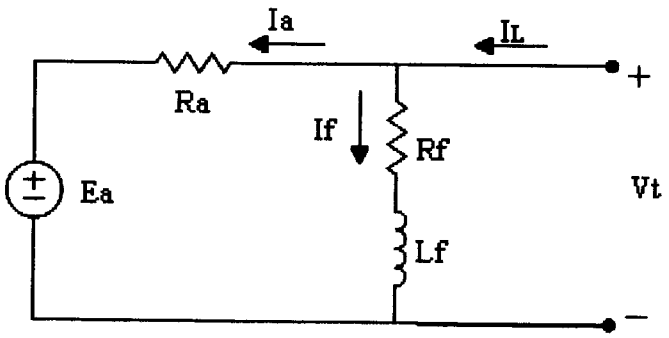

FIGURE Q7(b)