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CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JULY 2010 SESSION

SUBJECT CODE	:	FEB 10202
SUBJECT TITLE	:	ELECTRICAL PRINCIPLES
LEVEL	:	BACHELOR
TIME / DURATION	:	9.00am – 11.30am (2.5 HOURS)
DATE	:	09 NOVEMBER 2010

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 B. Answer all questions in Section A. For Section B, answer three (3) questions only.
6. Answer all questions in English.

THERE ARE 7 PAGES OF QUESTIONS AND 1 PAGE OF FORMULA, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

(a) State the definition of:

i. Voltage

ii. Current

iii. Resistance

(3 marks)

(b) If a resistor with a current of 2A through it converts 1000J of electrical energy into heat energy in 15s, what is the voltage across the resistor?

(4 marks)

(c) Determine the resistance and tolerance of each of the following 4-band resistors:

i. Brown, gray, red, silver

ii. Red, violet, orange, gold

(4 marks)

(d) Refer to Figure 1, by given total resistance, RT = 773 Ω, determine:

i. The Vs.

ii. The value of each resistor.

iii. The total power delivered to the circuit.

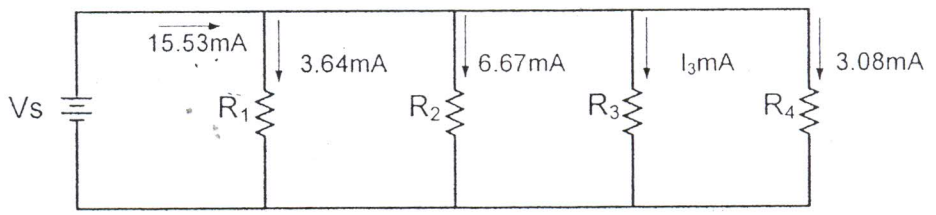


Figure 1

(9 marks)

Question 2

(a) Give 3 parameters contributing to the inductance of a coil.

(3 marks)

(b) A technician wraps 100 turns of wire on a small cylindrical plastic tube that is 7mm in diameter. The plastic tube is a non magnetic core which has equivalent permeability as vacuum ($4\pi x10^{-6}$ H/m). Determine the inductance of the coil formed.

(3 marks)

(c) An electronic circuit of inductances is shown in figure 2. The rms current flowing in L_3 is 50mA. Determine :

i. IL_1 , current flow in L_1

(5 marks)

ii. IL_2 , current flow in L_2

(2marks)

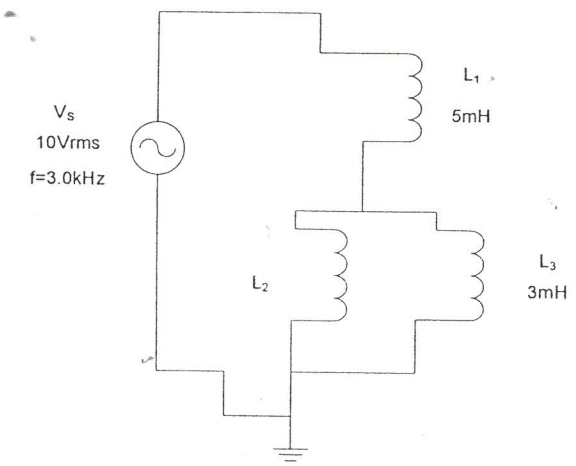


Figure 2

(d) Give 3 examples of electromagnetic devices.

(3 marks)

(e) A technician is developing a simple transformer coil as depicted in figure 3. Calculate:

i. The flux established if the reluctance of the material is $2.8x\ x10^5$ At/Wb.

ii. The turns needed if available current is 0.2 A, to maintain the flux established in (e)-(i).

(4 marks)

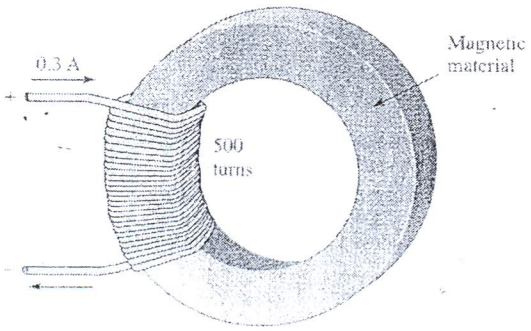


Figure 3

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) questions only

Please use the answer booklet provided.

Question 3

Based on the circuit in Figure 4:

(a) When the switch at position B, determine:

i. The total resistance of the circuit.

ii. The current measured in meter A.

iii. The current flow in R.

(10 marks)

(b) When switch at position A, determine:

i. The total resistance of the circuit.

ii. The current measured in meter A.

iii. The total amount of power in the circuit.

(10 marks)

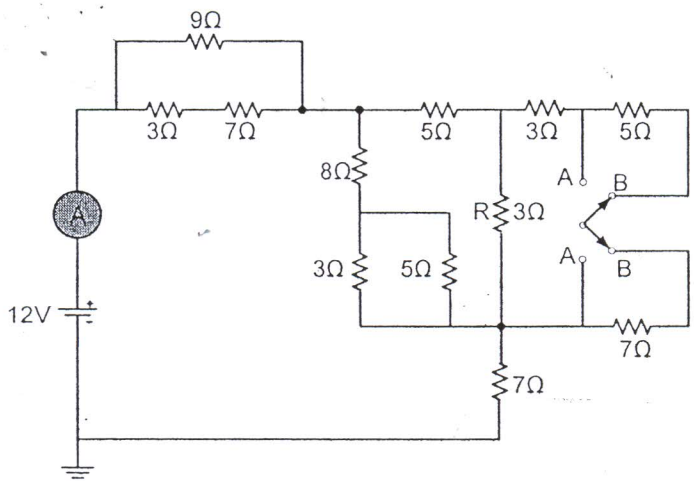


Figure 4

Question 4

Figure 5 shows Series-parallel circuit, calculate:

(a) the total impedance Z_T (5 marks)

(b) the supply current I (3 marks)

(c) the circuit phase angle and power factor PF (2 marks)

(d) currents I_1 and I_2 (4 marks)

(e) total true power, P_{true} (2 marks)

(f) total reactive power, P_r (2 marks)

(g) Apparent power, P_s (2 marks)

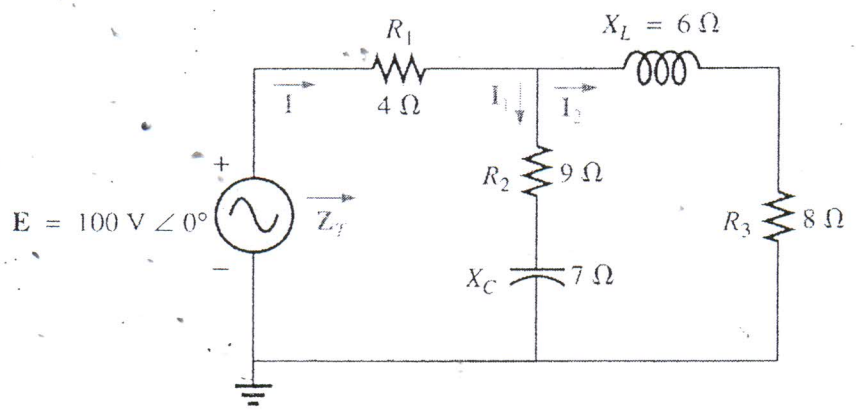


Figure 5

Question 5

(a) Three identical coils, each with resistance of 15Ω and inductance of 55 mH are connected to a 415V, 50 Hz, 3-phase supply. Determine the total power dissipated in this circuit for the delta connection (5 marks)

(b) A 415V , 3-phase, 4 wire, star connected system supplies three resistive loads as shown in Figure 6. Determine:

i. The current in each line, which is I_R, I_Y and I_B
ii. The current in the neutral line

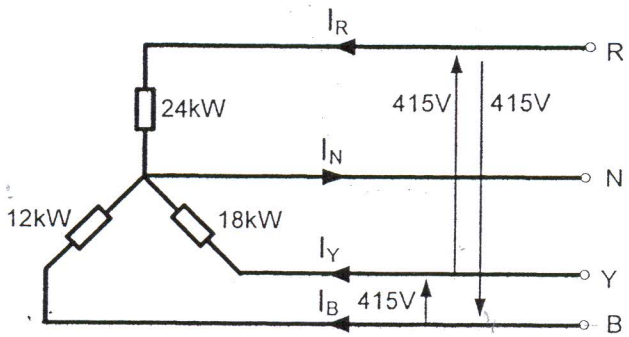


Figure 6

(15 marks)

Question 6

A transformer is designed for audio applications following a certain specifications. The objective is to maximize power transfer to the loud speakers. There are 3 speakers mounted in parallel, with each specified at 900 Ω. Assume audio source as pure sinusoidal with 1.096V peak amplitude and with internal resistance of 75 Ω. Two types of coils (coil 1 for primary and coil 2 for secondary) have been chosen as primary and secondary windings of the transformer. Common characteristics for both coils are that it is of cylindrical type with length of 1.5cm and diameter 0.5cm. Permeability of the core is 0.25×10^{-3} H/m.

(a) Determine the turns ratio needed for the transformer, given that the load resistor, RL need to be viewed identical to source internal resistance.

(4 marks)

(b) Given the turns on the primary of transformer is 350, determine L1 and L2.

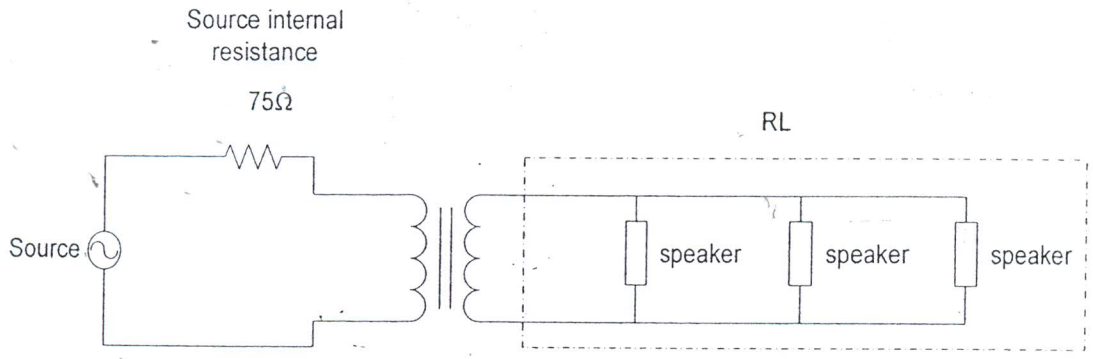
(8 marks)

(c) Coil 1 produces total magnetic flux of $\Phi_1 = 50\mu Wb$. Due to many factors, i.e physical closeness and core material, the flux produced by linking winding 1 to winding 2 is $\Phi_{1-2} = 20\mu Wb$. Calculate the mutual inductance achieved for the transformer, L_M.

(3 marks)

(d) Given that only a total current of 2 A_{RMS} is allowed in the speakers, determine the most economical power rating for the transformer.

(5 marks)



END OF QUESTION PAPER

FORMULA

CAPACITANCE	TRANSFORMER
Capacitance , $C = \frac{Q}{V}$	Circle area = $\pi \times r^2$
Capacitance, $C = \frac{A \cdot \varepsilon_r \cdot (8.85 \times 10^{-12}\ \text{F/m})}{d}$	Inductance, L = $\frac{N^2 \times \mu \times A}{l}$
Capacitive reactance, $C = \frac{1}{2\pi \cdot f \cdot C}$	Coeficient of coupling, $k = \frac{\Phi_{1-2}}{\Phi_1}$
INDUCTANCE	Mutual inductance , $L_M = k * \sqrt{L_1 \times L_2}$
Circle area = $\pi \times r^2$	Turns ratio , $n = \frac{N_{sec}}{N_{prim}} = \frac{V_{sec}}{V_{prim}} = \frac{I_{prim}}{I_{sec}}$
Inductance, L = $\frac{N^2 \times \mu \times A}{l}$	Reflected resistance, $R_{prim} = \frac{R_L}{n^2}$
Inductive reactance, $X_L = 2\pi \cdot f \cdot L$	
MAGNETISM	
Magnetic Flux Density, $B = \frac{\Phi}{A}$	
Relative permeability, $\mu_r = \frac{\mu}{\mu_0}$	
Magnetic Flux, $\Phi = \frac{F_M}{\Re}$	
Magnetomotive force, $F_M = N \cdot I$	
Reluctance, $\Re = \frac{l}{\mu \cdot A}$	

(20 marks)

END OF QUESTION PAPER