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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FED11103**
SUBJECT TITLE	:	**CIRCUIT THEORY**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**9.00 AM – 12.00 PM (3 HOURS)**
DATE	:	**6 JANUARY 2015**

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 two (2) questions only.**
6. **Answer all questions in English.**

THERE ARE 9 PAGES OF QUESTIONS, EXCLUDING THIS PAGE AND APPENDIX.

SECTION A(Total:60marks)

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

Question 1

a) Provide the definition of:

i. Node
ii. Voltage
iii. Kirchhoff Voltage Law

(6 marks)

b) Determine the color code for the following values of 4-band resistors:

i. 56 kΩ ± 5%
ii. 210 Ω ± 10%

(2 marks)

c) A student has bought an automatic washing machine. It consumes 0.48A with 240V supply. Calculate the power dissipation, P (inwatts) and the energy used (injoules) if it is being used for 2 hours. Consequently determine how much the student has to pay every month for a consumption of 60 hours assuming a flat rate of RM0.45/kWh.

(4 marks)

d) Based on the circuit shown in**Figure 1,** determine:

i. Total equivalent resistance $\boldsymbol{R_T}$, composed of all resistors in the circuit.

(3 marks)

ii. The total current flow in the circuit,$\boldsymbol{I_T}$.

(2 marks)

iii. The voltage, $\boldsymbol{V_{BG}}$.(voltage across $\boldsymbol{R_6}$)

(3 marks)

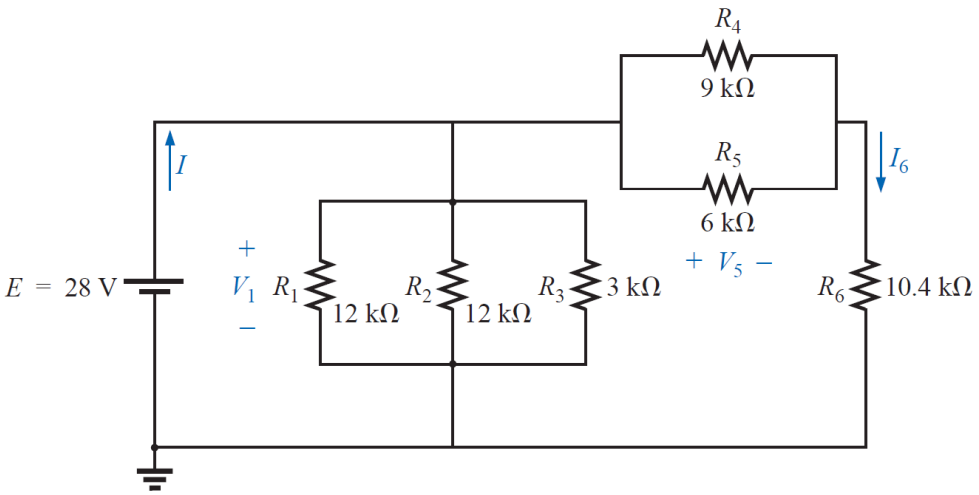

Figure 1

Question 2

a) State 3 (three) factors affecting the capacitance value.

(3 marks)

b) An unplugged old television is being repaired by a technician. A certain capacitor in the TV is still having some amount of charge. Determine the conditions below:

i. The capacitor value is 47μF with a charge of of 5.64mC. Calculatethe amount of voltagepresent.

(2 marks)

ii. Due to negligence, the technician has touched the metal part of capacitor with bare hands (assume there are favorable conditions for electric flow). Determine the amount of current flowing through the body of the technician assuming the resistance of the technician's body is 20kΩ. Will the technician perceive the electric flow?(perception level starts at >1mA).

(2 marks)

c) Draw in time domain one complete cycle of the sinusoidal waveform for the following signal: $v\ t\ = 340\sin(314t)$. Mark all zero crossings of both axis and all peaks.

(3 marks)

d) Convert the following from the time to the phasor domain.

(i) $33\sin(\omega t)$

(ii) $100\sin(\omega t - 60°)$

(2 marks)

e) An electronic circuit is shown in **Figure2**. Determine :

i. The time constant τwhen switchis at position S1.

(2 marks)

ii. Voltage level reached at t = 2us .

(3 marks)

iii. Switch is at position S2. Calculate the new τ andvoltage level reached at t = 9.8us.

(3marks)

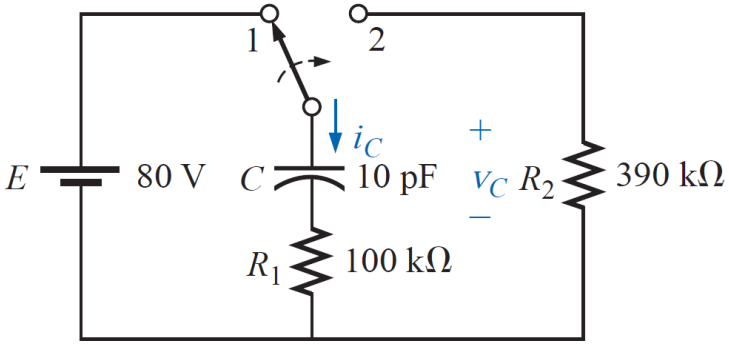

Figure 2

Question 3

(a) State 3 factors affecting the inductance value.

(3 marks)

(b) Find the expected measured dc voltage across a certain coil if the current through the12-mH coil is as shown in**Figure** 3.Given the instantaneous voltage of inductor $V_L = L \cdot \frac{\Delta I}{\Delta t}$.

(i) At t= 8ms

(ii) At t=12ms

(iii) At t=21ms

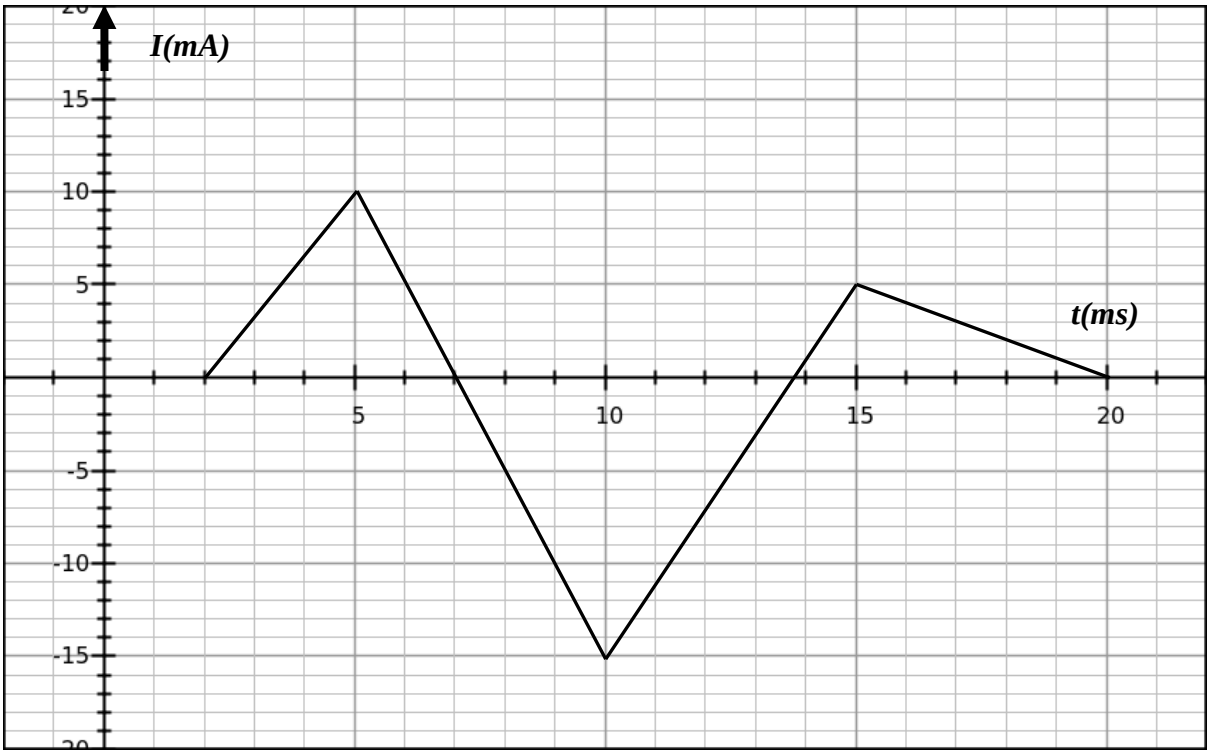

Figure 3

(6 marks)

(c) Consider the inductance circuit in**Figure 4**.Perform the analysis as follows:

(i) Find the steady state current of the circuit, I_f. (Hint : use ohm's law to resistive circuit).

(2 marks)

(ii) Determine the time constant τ

(2 marks)

(iii) Determine the inductor's current, $I_L$at t = 22.2us.

(3 marks)

(iv) Find the corresponding inductor voltage, $V_L$at t = 22.2us.

(4 marks)

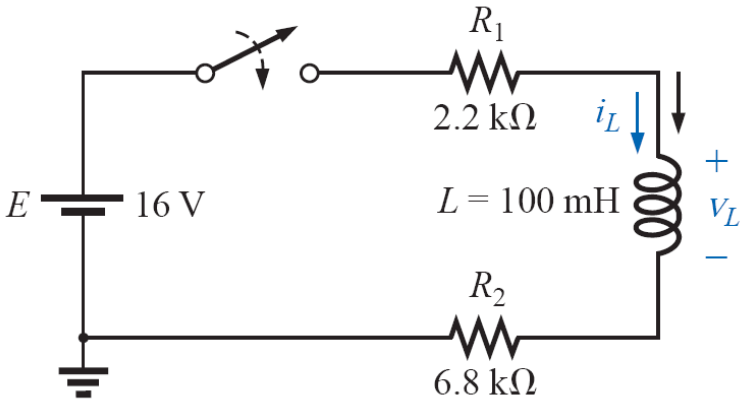

Figure 4

SECTION B(Total:40marks)

INSTRUCTION: Answer TWO (2) questions only

Please use the answer booklet provided.

Question 4

Referring to**Figure 5**, and by using the superposition theorem, determineI_3.

(20 marks)

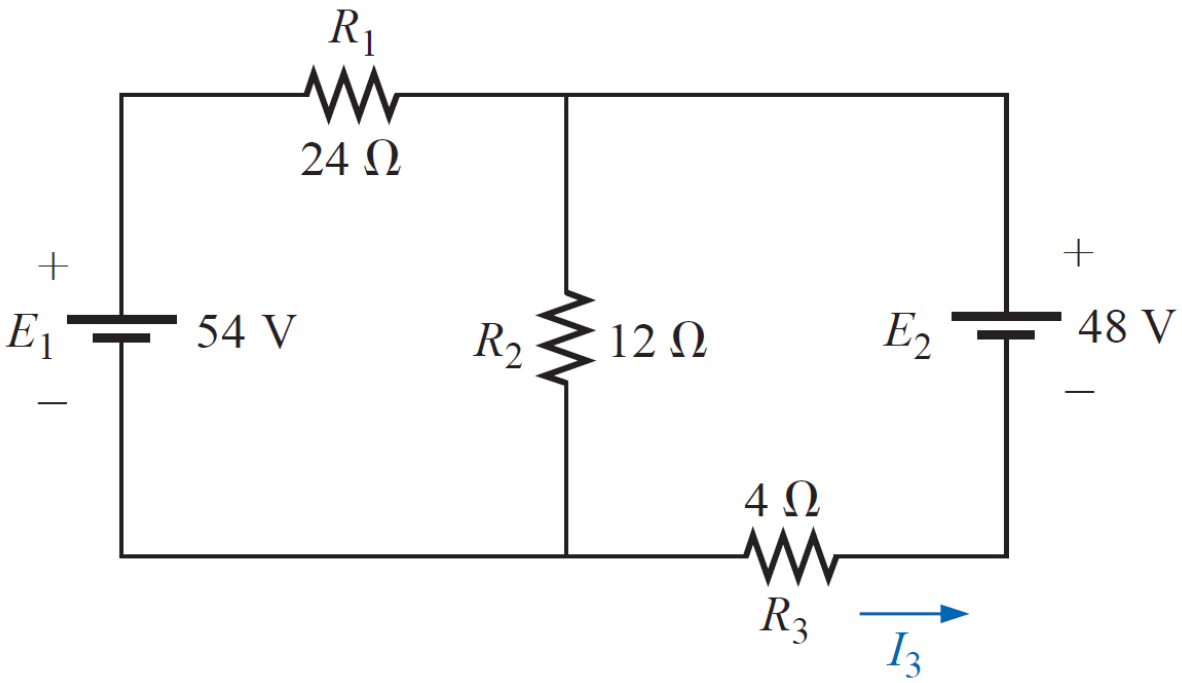

Figure 5

Question 5

For the series-parallel circuitry as shown in**Figure 6**, determine:

(a) the equivalent total circuit impedanceZ_T

(5 marks)

(b) the supply current I

(2 marks)

(c) the circuit phase angle and power factor PF

(2 marks)

(d) voltage $V_2$and current I_3

(4 marks)

(e) currentI_2 and voltage V_3

(4 marks)

(f) Find the total apparent power **S**, total true power, $P_{true}$and total reactive power, Q_r.

(3 marks)

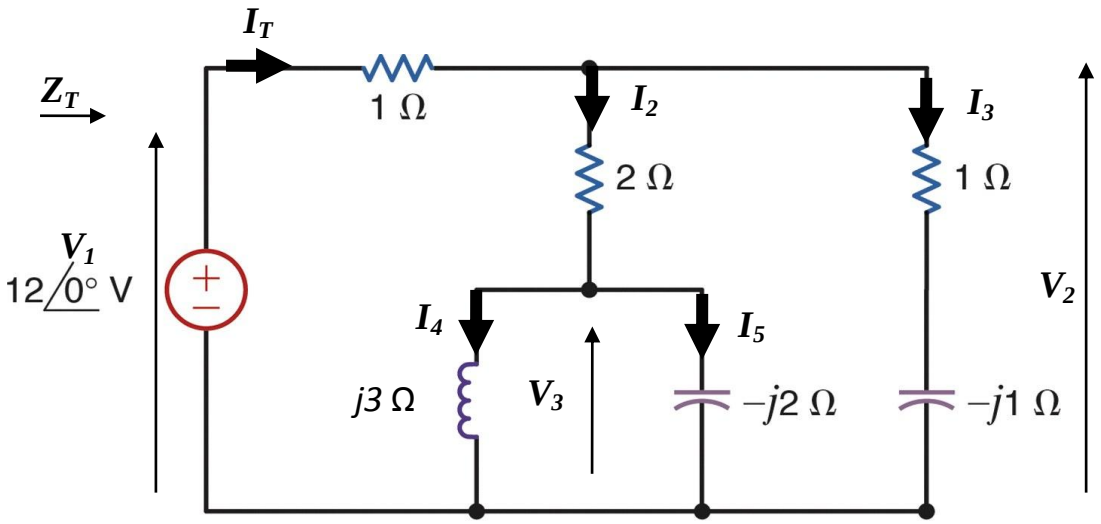

Figure 6

Question 6

A 3-phase induction motor with three identical coils, each with resistance of 5Ω and inductance of 80mH are connected to a 415V, 50 Hz, 3-phase supply. Determine the main parameters in this circuit for:

(a) The star connection

(i) Inductive reactance, X_L

(2 marks)

(ii) Phase impedance Z_P

(2 marks)

(iii) Phase voltage, V_P

(2 marks)

(iv) Phase current, I_P

(2 marks)

(v) Line current, I_L

(1 marks)

(vi) Power factor , $\cos\varphi$

(2 marks)

(vii) Power dissipated, P

(2 marks)

(b) The delta connection

(i) Phase voltage, V_P

(1 marks)

(ii) Phase current, I_P

(2 marks)

(iii) Line current, I_L

(2 marks)

(iv) Power dissipated, P

(2 marks)

END OF QUESTION PAPER

APPENDIX

FORMULA

CAPACITANCE

Capacitance , $C = \frac{Q}{V}$

Capacitance, $C = \frac{A \cdot \varepsilon_r \cdot (8.85 \times 10^{-12}\ \text{F/m})}{d}$

Capacitive reactance, $X_C = \frac{1}{2\pi \cdot f \cdot C}$

Time constant, $\tau = R \cdot C$

INDUCTANCE

Voltage induced $V_L = L \cdot \frac{\Delta i}{\Delta t}$

Circle area = $\pi \times r^2$

Inductance, L = $\frac{N^2 \times \mu \times A}{l}$

Inductive reactance, $X_L = 2\pi \cdot f \cdot L$

Time constant, $\tau = \frac{L}{R}$

CHARGE/DISCHARGE

Voltage $V = V_F + (V_I - V_F) \cdot e^{-\frac{t}{\tau}}$

Current $I = I_F + (I_I - I_F) \cdot e^{-\frac{t}{\tau}}$