Document No : UniKL MFI_SD_AC41
Revision No: 02
Effective Date: 01 December 2008

**CONFIDENTIAL**

**SET A**

# UNIVERSITI KUALA LUMPUR
## Malaysia France Institute

## FINAL EXAMINATION

## SEPTEMBER 2013 SESSION

| | | |
|---|---|---|
| **SUBJECT CODE** | : | **FED11103** |
| **SUBJECT TITLE** | : | **CIRCUIT THEORY** |
| **LEVEL** | : | **DIPLOMA** |
| **TIME / DURATION** | : | **2.5 HOURS** |
| **DATE** | : | |

**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.**

**SECTION A(Total:60marks)**

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

**Question 1**

(a) Give the definitions of the following electric circuit elements:

(i) Series circuit

(ii) Parallel circuit

(iii) Node

(6 marks)

(b) Determine the maximum and minimum resistance value of the following 4-band color coded resistors:

(i) Green, blue, orange, gold

(3 marks)

(c) A USB charger has an output of 5Vdc supply with 3 sockets. It is used to charge mobile devices.Identical mobile devices were plugged toall sockets. Assume each mobile device will draw 1A for charge duration below 2 hours. It is now connected for 1 hour. Calculate:

(i) the power dissipation, P (in watts)

(ii) the energy used ( in Wh and in Joules ).

(iii) Determine the electricity cost if a flat rate of RM0.43 per kWh is applied.

(5 marks)

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

(i) The total circuit current $I_S$.

(4 marks)

(ii) Determine $I_1$.

(2 marks)

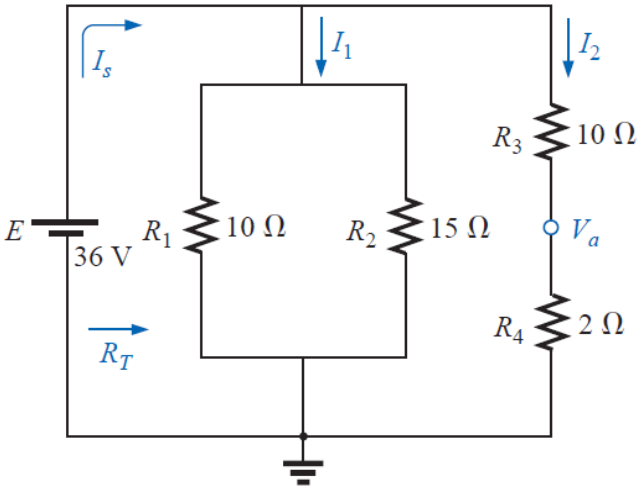



**Figure 1**

**Question 2**

(a) Convert the following from the time to the phasor domain.

(i) $\sqrt{2}(25)\sin(\omega t)$

(ii) $34.8\sin(\omega t + 72°)$

(iii) $23\cos(\omega t)$

(3 marks)

(b) Write the sinusoidal expression for the following phasor if the frequency is 60 Hz:
I= $10\angle 30°$ A

(2 marks)

(c) Summarize in one (1) sentence to describe the CAPACITOR.

(3 marks)

(d) Calculate the parameters below:

(i) Determine the voltage across a 2200pF capacitor storing 40μC of charge.

(2 marks)

(ii) A certain capacitor stores 25μC with 5V across its plates. Calculates its capacitance.

(2 marks)

(e) An electronic circuit is shown in**Figure 2**.Determine :

(i) The time constant τwhen ONLY switch S1 is closed.

(2 marks)

(ii) Voltage level reached at t = 66ms.

(3 marks)

(iii) Capacitor fully charged, then ONLY switch S2 is closed. Calculate the voltage level reached at t = 33ms.

(3marks)

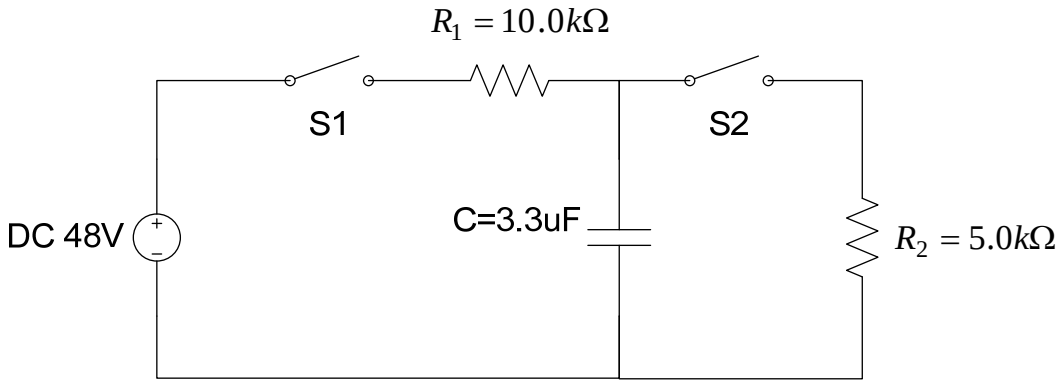



**Figure 2**

## Question 3

(a) Summarize in one sentence what you understand by INDUCTANCE.

(3 marks)

(b) Find the expected measured DC voltage across a certain coil if the current through the4-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= 3ms

(ii) At t=6ms

(iii) At t=10ms

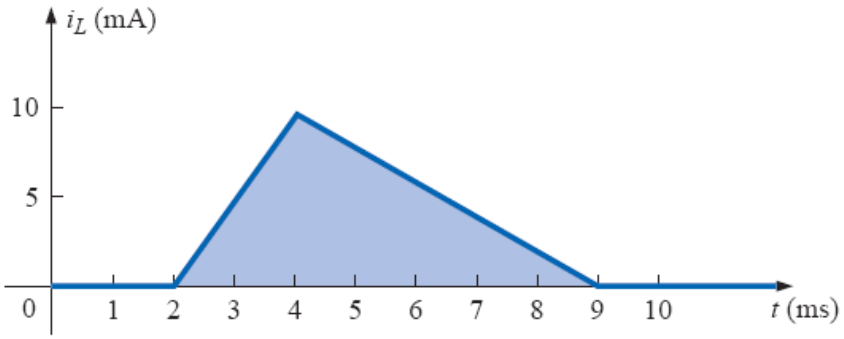



**Figure 3**

(6 marks)

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

(i) Starting with ONLY switch S1 closed, find the steady state current of the circuit, $I_f$. ( Hint : use OHM's law to resistive circuit)

(2 marks)

(ii) Determine the inductor's current, $I_L$ at t = 4.0us.

(3 marks)

(iii) The inductor's current reaching the steady state, then circuit changes with ONLY switch S2 closed. Find the inductor's current, $I_L$ att = 8.0us.

(3 marks)

(iv) The circuit is now completely without power, consider the circuit with both switches closed, then the supply is turned ON. Assuming the circuit has reached steady state, then ONLY switch S1 is opened (S2 remains closed). Find the inductor's current, $I_L$ at t = 4.0us.

(3 marks)

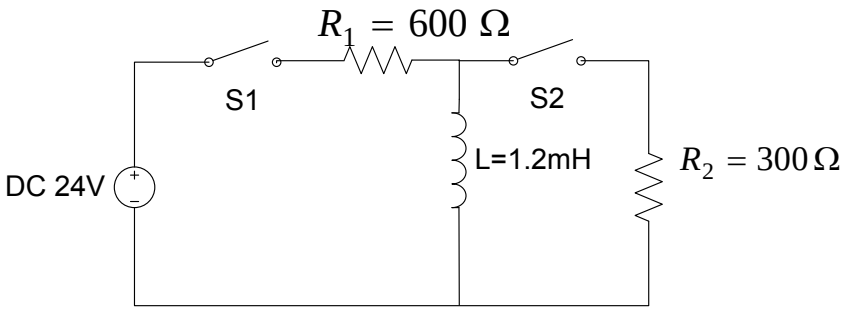



**Figure 4**

**SECTION B(Total:40marks)**

**INSTRUCTION: Answer TWO (2) questions only**

**Please use the answer booklet provided.**

**Question 4**

Referring to **Figure5**, and by using the Thevenin theorem, find:

(a) $Z_{TH}$, the impedance of the Thevenin circuit.

(8marks)

(b) $E_{TH}$, the Thevenin voltage.

(7 marks)

(c) Redraw completely the new circuit of **Figure 5**with Thevenin voltage and impedance. Use only AC source(s), resistance(s), inductance(s), capacitance(s) and grounding.

(5marks)

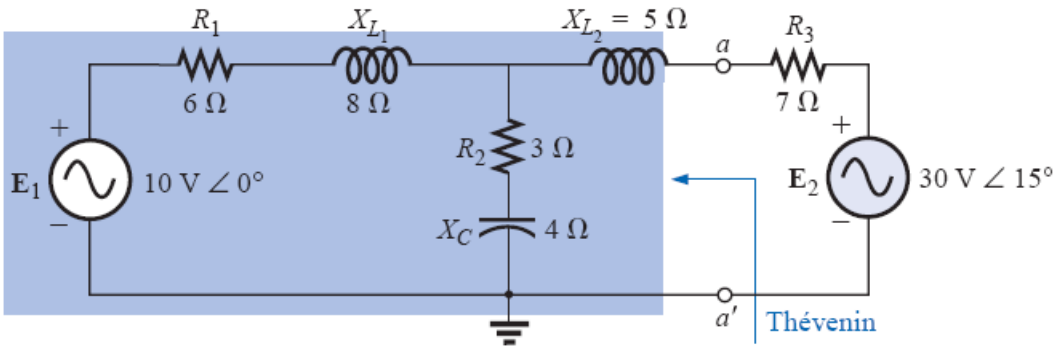



**Figure 5**

## Question 5

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

(a) the equivalent total circuit impedance$Z_T$

(5 marks)

(b) the total supply current $I_T$

(2 marks)

(c) the circuit phase angle and power factor *PF*

(2 marks)

(d) currents $I_1$and $I_2$

(4 marks)

(e) voltages $V_1$and $V_2$

(4 marks)

(f) total true power, *P*

(2 marks)

(g) total reactive power, *Q*

(1 mark)

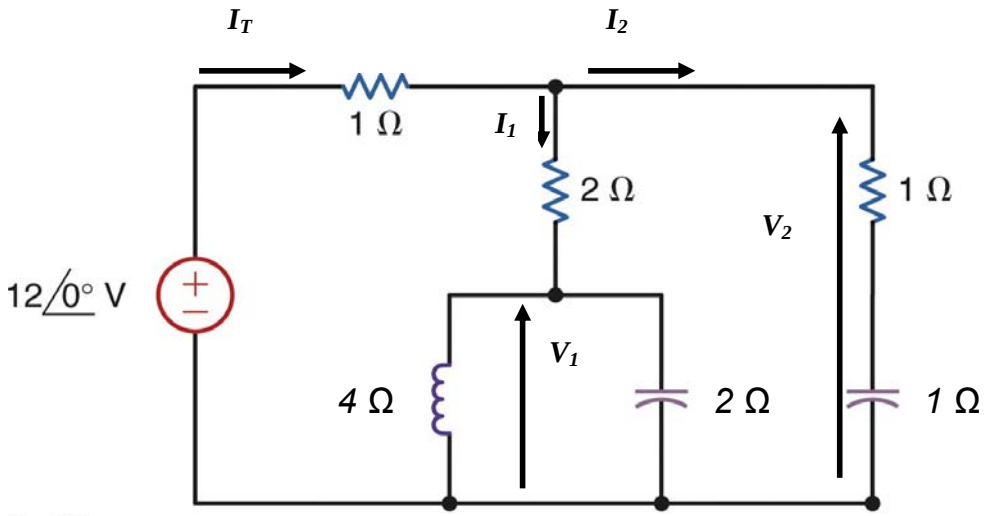



**Figure 6**

**Question 6**

Three identical coils, each with resistance of 10Ω and inductance of 42 mH 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 mark)

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

(2 marks)

(vii) Power dissipated, P

(2 marks)

(b) the delta connection

(i) Phase voltage, $V_P$

(1 mark)

(ii) Phase current, $I_P$

(2 marks)

(iii) Line current, $I_L$

(2 marks)

(iv) Power dissipated, P

(2 marks)

**END OF QUESTION PAPER**

## 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,** $\tau = R \cdot C$

### CHARGE/DISCHARGE

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

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

### INDUCTANCE

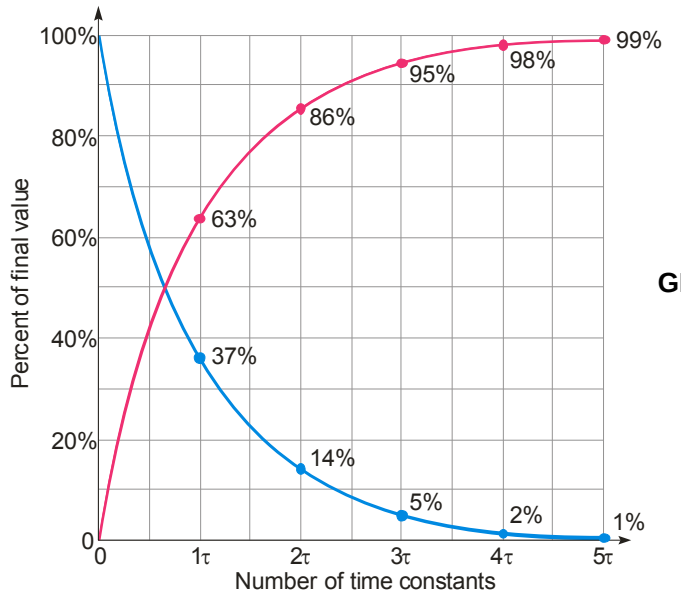
**Voltage induced** $V_L = L \cdot \frac{\Delta i}{\Delta t}$

**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,** $\tau = \frac{L}{R}$




**GRAPH : EXPONENTIAL CURVE**