FNU FIJI NATIONAL UNIVERSITY

College of Engineering, Science & Technology

SCHOOL OF ELECTRICAL & ELECTRONICSENGINEERING

TRADE DIPLOMA IN ENGINEERING (ELECTRICAL & ELECTRONICS MAJOR)

EEE466 – CIRCUIT ANALYSIS

SA/SE/Re-SIT EXAMINATION – PENSTER-1, 2017

DAY/DATE: 06/03/2017 TIME : 9.00-12.00pm DURATION: 3HRS.10min

ROOM: SAMABULA CAMPUS

INSTRUCTION TO STUDENT

1. You are allowed 10 minutes extra reading time during which you are NOT to write.

2. **Begin** each answer(each Question) on a fresh page and use both sides of the sheet.

3. Write your candidate number at the top of each answer & attached sheet.

4. Insert all written foolscaps, graph paper etc. in their correct sequence and secure with a string.

5. For all sheets of paper on which rough/draft work has been done, cross it through and you must attach all of them to your answer scripts.

6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.

7. Tables & formula on the Appendix.

8. **SECTION A. – Multiple Choice & Short Answer**   -20 marks
   SECTION B. – Answer ALL question   -50 marks
   SECTION C. – Select any three(3) question.   -30 marks

Section – A: [20 marks]

Multiple Choice (12 marks)

In this section, read the question properly/ carefully and select your best answer by writing the alphabet of your choice along the question number in the answer sheet.

(1 mark each)

1. The value of natural logarithm e is approximately?

   (a) 2.718
   (b) 2.728
   (c) 3.142.
   (d) 2.782.

2. In RC Timing circuits, during the 1st time constant, the capacitor is charged to about ---- of the source voltage.

   (a) 62.3%
   (b) 63.2%
   (c) 62.4%.
   (d) 62.7%.

3. What is the *frequency* component of the following voltage equation, $v = 12\sin 377t + 70^0$.

   (a) 497
   (b) 70
   (c) 377
   (d) 377+70

4. What is the *phase shift* component of the following voltage equation, $v = 12\sin 377t + 70^0$.

   (a) 377t + 70
   (b) 70
   (c) 377
   (d) 12

5. Determine what *frequency* will an inductor of 5mH will have the same reactance with a capacitor of 0.1uF?
   (a) 712kHz
   (b) 7.21kHz
   (c) 7.12kHz
   (d) 721kHz.

6. In a RCL series circuit, a 240v supply with 50 Hz connected with a resistor of 20Ω, capacitor of 80μF and inductor of 0.25H. Determine the _inductive_ reactance?

(a) 785.3kΩ
(b) 785.3Ω
(c) 78.53kΩ
(d) 78.53Ω.

7. In a RCL series circuit, a 240v supply with 50 Hz connected with a resistor of 20Ω, capacitor of 80μF and inductor of 0.25H. Find the _capacitive_ reactance?

(a) 39.79Ω
(b) 39.79kΩ
(c) 39.79MΩ
(d) 39.97Ω.

8. In a RCL series circuit, a 240v supply with 50 Hz connected with a resistor of 10Ω, capacitor of 60μF and inductor of 0.20H. The _impedance_ of the circuit will be:-?

(a) 42.60Ω
(b) 13.93Ω
(c) 43.6kΩ
(d) 42.60kΩ.

9. Convert the following voltage $v_a = 50\ sin(377t + 30^0)$ from _time domain_ into _phasor domain_ and re-write the voltage into phasor format.

(a) $v_a = 70.71v\ \angle 30^0$

(b) $v_a = 35.35v\ \angle 21^0$

(c) $v_a = 70.71v\ \angle 21^0$

(d) $v_a = 35.35v\ \angle 30^0$.

10. Which of the following dependent sources is not appropriate?

(a) voltage controlled voltage source
(b) current controlled voltage source
(c) voltage controlled current sense
(d) current controlled current source

11. A system of 120V dc delivers 4.6W to the load as per diagram below. Find the *peak value* of the applied *voltage (E_m)* and the *current (I_m)* if the source to delivered same power to the same load.
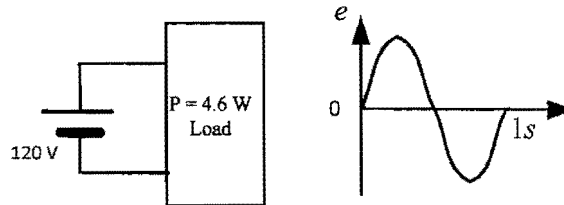
(a) $E_m = 149.24v$, $I_m = 42.54mA$
(b) $E_m = 159.86v$, $I_m = 42.42mA$
(c) $E_m = 84.85v$, $I_m = 54.21mA$
(d) $E_m = 169.71v$, $I_m = 54.21mA$

12. In a purely capacitive circuit, current (*i*) leads voltage (*v*) by 90°, determine the average power in the capacitor.
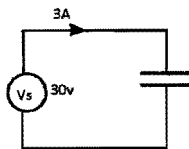
(a) $P_{av} = 0w$
(b) $P_{av} = 45w$
(c) $P_{av} = 100w$
(d) $P_{av} = 1Kw$

Short Answer   (8 marks)

In this section, read the question properly/ carefully and determine your answer correctly by writing it in the answer sheet provided.

1. The voltage across a 5.6μF Capacitor is given as v = 35 sin 300t. What is the sinusoidal expression for the current?   [2 marks]

2. Name 2 types of dependent power sources.   [2 marks]

3. Determine the average power delivered to networks having the following input voltage and current as described below: -   [2 marks]

$$v = 120\sin(\omega t - 60^0)$$
$$i = 20\sin(\omega t - 45^0)$$

4. Find the Effective Values(RMS) of the sinusoidal waveform in graph below:-
                                                                   [2 marks]
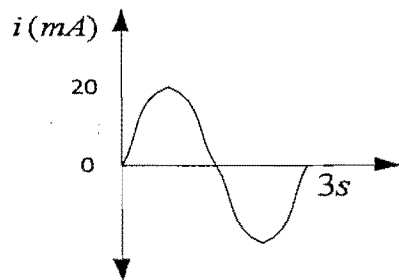
## Question 1   -   Series/Parallel Resistor Network

(a).   A resistive circuit is given below. Workout the Req between terminal a and b.

(4 marks)
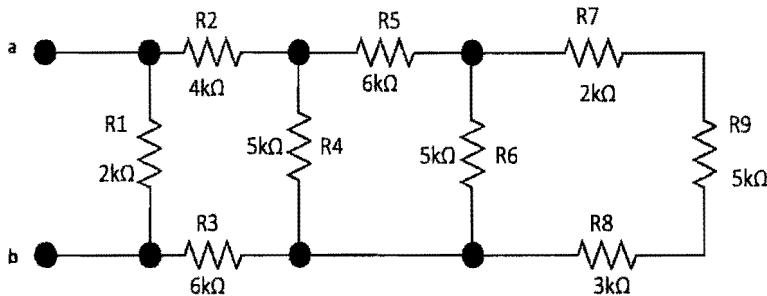
(b).   For the Series/Parallel Resistive network circuit below, find the following:-

i)   The voltage across each resistor.   *(4marks)*
ii)   The current through the circuit.   *(1mark)*
iii) If there is a short between points c-b, work out the current through the
      parallel branch   *(3marks)*
iv)   The current through the circuit if points a-b is shorted.   *(2marks)*
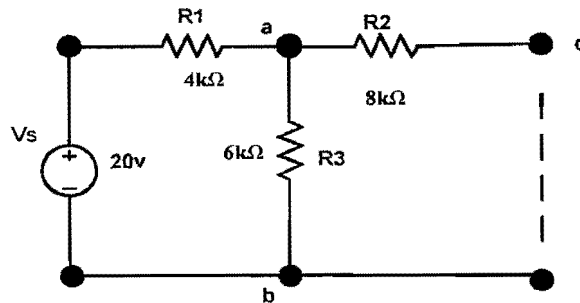
(c).   Find the current flowing through each branch of the circuit in figure below....
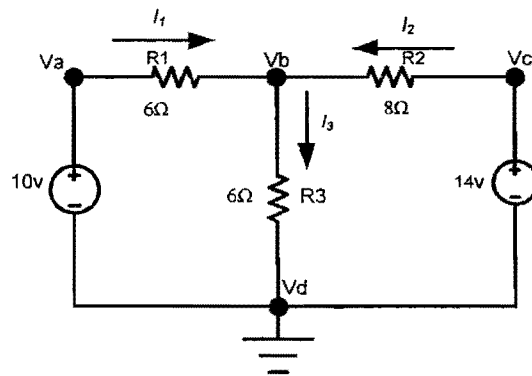
(6 marks)
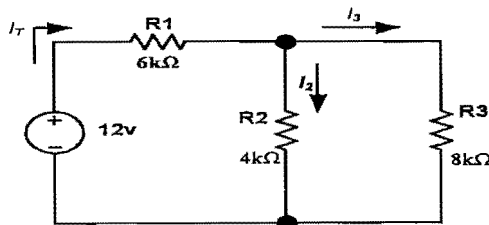
Question 2   - Nodal Analysis

(a). Using Nodal Analysis method, find the voltage at node "a" & node "b" in a circuit given below.   **(10 marks)**
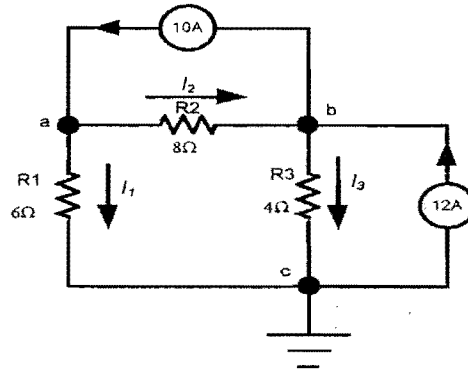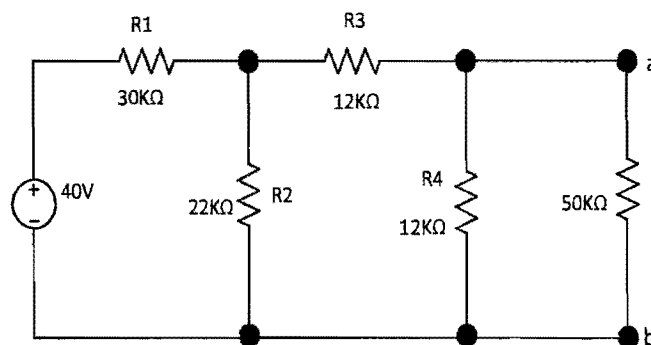

(b). Find the current in each resistor in the circuit below.   **(10 marks)**

Question 3   - Thévenin's Theorem

From the circuit given below, determine Thévenin's equivalent circuit and calculate the current through the load resistor.   **(10 marks)**
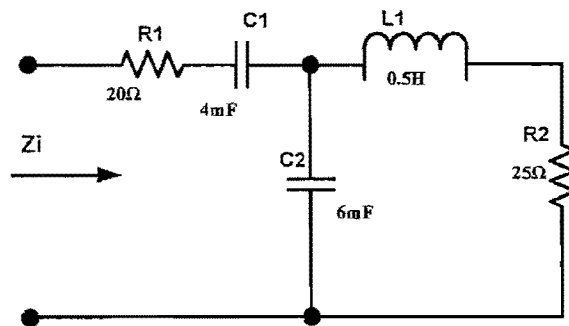
Section – C: [30 marks]

Select any THREE (3) questions from the seven(7) question given below.

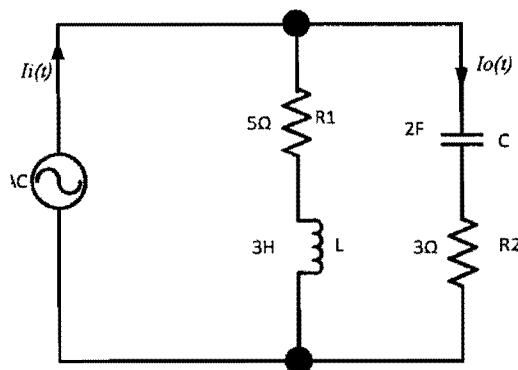## Question 1

Use complex algebra [j-notation] application to:-

    i.   Determine the input impedance of the circuit shown below.   [7 marks]
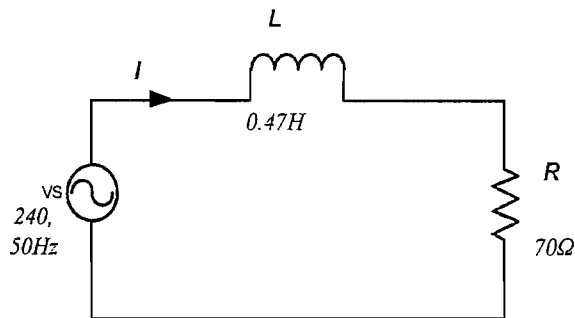   ii.   Plot its phasor diagram   [3 marks]

(use ω =10 rad/s)

Question 2

For the circuit below, *show the full calculation* of the Gain = I_O (w) / I_I(w) and
determine the poles and zeroes of the circuit below using the RL and RC responses.

(10 marks)

Question 3.

(a).   Determine the impedance and its phase angle of the RL circuit below?

(6 marks)

(b).   The voltage across a 3uF Capacitor is given as $v = 30\sin 377t$. What is the sinusoidal expression for the current and Sketch the *voltage* and *current* curves.

(4 marks)

Question 4

For the RLC circuit below, resistor = 8Ω, capacitor = 0.6uF and inductor = 6mH, show all the necessary calculation to determine the following:-   **(10 marks)**
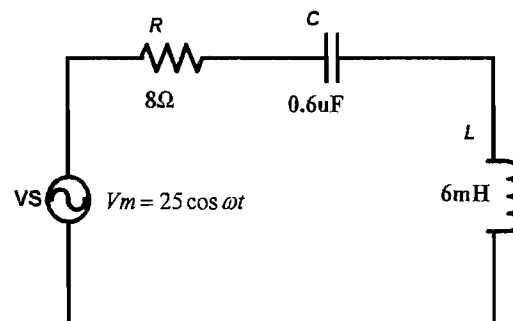
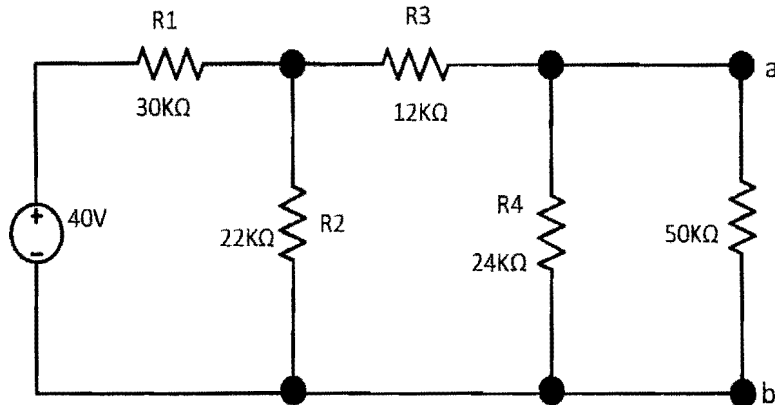(use $\pi = 3.14$)

a) The resonant frequency   (2 marks)
b) Half power frequencies   (4 marks)
c) Quality Factor   (2 marks)
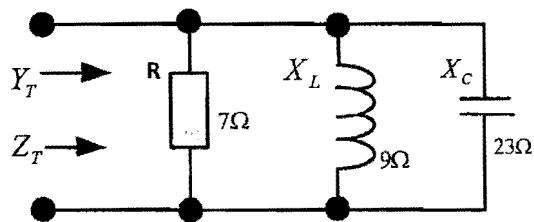d) Bandwidth   (2 marks)

Question 5

For the circuit shown below, calculate and determine the Norton's equivalent circuit.
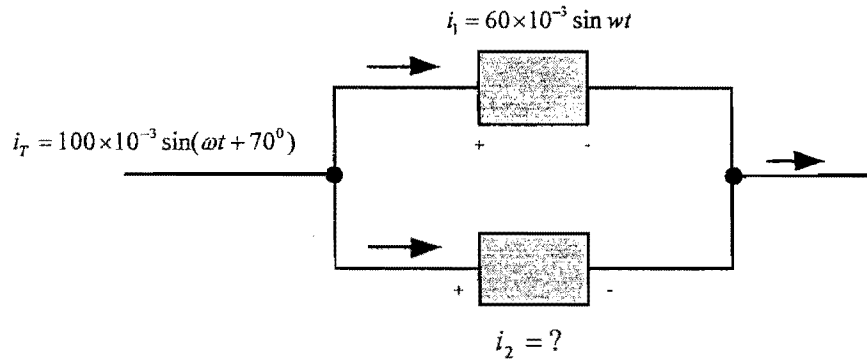
(10 marks)

Question 6

For the parallel RCL network below.   (10 marks)

i.	Find the admittance of each parallel circuit.	(3 marks)
ii.	Determine the input admittance.	(2 marks)
iii.	Calculate the input impedance	(2 marks)
iv.	Draw the input impedance diagram.	(1½ marks)
v.	Draw the admittance diagram.	(1½ marks)

Question 7

Determine the current i_2 for the network in the circuit below.   **(10 marks)**

$$i_1 = 60 \times 10^{-3} \sin wt$$

$$i_T = 100 \times 10^{-3} \sin(\omega t + 70^0)$$

$$i_2 = ?$$

-------------------- END OF PAPER-----------------------

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Appendix 1

Formulas

1. $\quad w_x = \dfrac{R}{2L} + \sqrt{\left(\dfrac{R}{2L}\right)^2 + \dfrac{1}{LC}}$

2. $\quad w_y = -\dfrac{R}{2L} + \sqrt{\left(\dfrac{R}{2L}\right)^2 + \dfrac{1}{LC}}$

3. $\quad f_0 = \dfrac{1}{2\pi\sqrt{LC}}$

4. $\quad Q = \dfrac{1}{w_0 CR}$

5. $\quad B = w_0^2\, CR$

6. $\quad X_L = 2\pi f L$

7. $\quad X_C = \dfrac{1}{2\pi f C}$

9. $\quad I_D = I_{DSS}\left(1 - \dfrac{V_{GS}}{V_P}\right)^2 , \qquad \beta_1\left[(V_{DD} - 2V_T)V_{ON} - 0.5^2{}_{ON}\right]$

10. $\quad f_H = \pm\dfrac{8 fo}{Vc} , \qquad V_{DS} = V_{DD} - I_D R_D$