UNIVERSITY OF SWAZILAND

FIRST SEMESTER EXAMINATION DECEMBER, 2008

FACULTY OF SCIENCE

DEPARTMENT OF ELECTRONIC ENGINEERING

TITLE OF PAPER:	ELECTRICAL CIRCUITS
COURSE CODE:	E310
TIME ALLOWED:	THREE HOURS

INSTRUCTIONS:

1. **Answer any <u>FIVE</u> (5) of the following SIX questions.**
2. **Each question carries 20 marks.**
3. **Calculators capable of solving simultaneous equations with three variables may be used.**
4. **If you think not enough data has been given in any question you may assume reasonable values**

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THIS PAPER CONTAINS EIGHT (8) PAGES INCLUDING THIS PAGE

QUESTION ONE ***(20 marks)***

(a) Find the voltage V_X and current I_X in the circuit shown in Fig.Q1a. *(8 marks)*

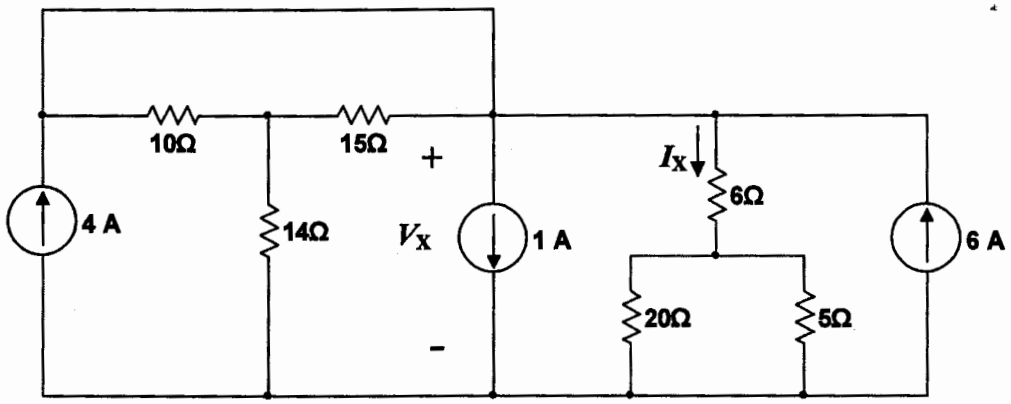

Fig.Q1a

(b) In the circuit shown in Fig.Q1b which features a voltage-dependent voltage source, find the voltage at Node A and the voltage V_X. *(12 marks)*

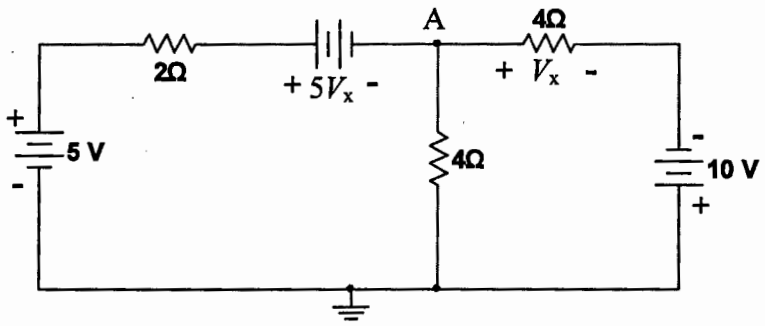

Fig. Q1b

QUESTION TWO (20 *marks*)

For the circuit shown in Fig. Q2,

(a) Find the Thevenin's equivalent circuit looking into the circuit from terminals A and B. *(16 marks)*

(b) Hence obtain the values of the passive components that could be used to represent the Thevenin equivalent circuit. *(4 marks)*

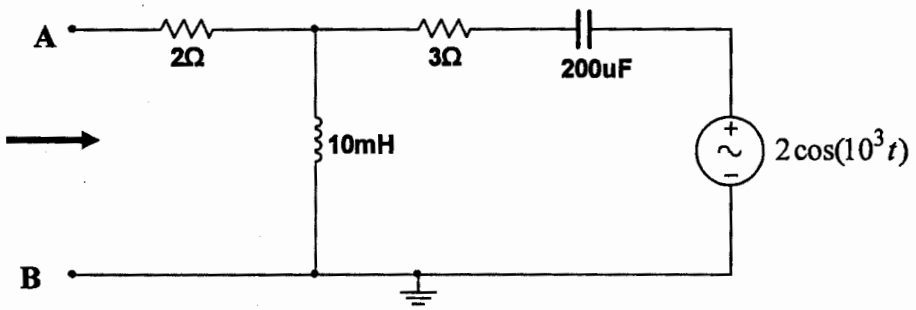

Fig.Q2

QUESTION THREE **(20 *marks*)**

An a.c. voltage source $e(t) = 25\sin(314t + 45°)$ supplies an inductive load whose impedance at the working frequency is $Z_L = 10 + j5\ \Omega$. Determine:

(a) An expression for the instantaneous power at any time t. Simplify your expression as much as possible. *(11 marks)*

(b) The apparent power delivered to Z_L. *(3 marks)*

(c) The reactive power delivered to Z_L. *(3 marks)*

(d) The average power delivered to Z_L. *(3 marks)*

QUESTION FOUR (20 *marks)*

(a) For the circuit shown in Fig.Q4a find:

(i) The value of Z_L for maximum power to be delivered to it. *(10 marks)*

(ii) The average power dissipated by Z_L when maximum power is delivered. *(3 marks)*

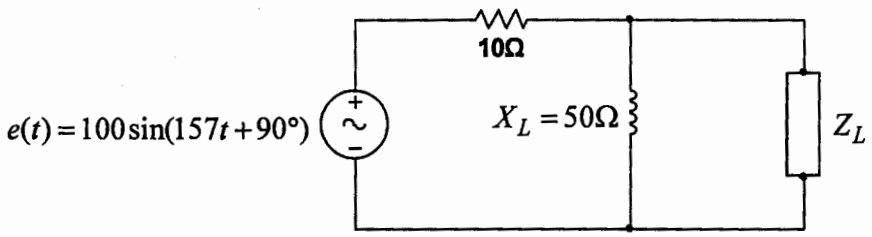

Fig.Q4a

(b) Given a circuit with applied voltage of $v = 150\sin(\omega t + 10°)$ and current of $i = 5\sin(\omega t - 50°)$. Determine

(i) The average power *(2 marks)*

(ii) The reactive power *(2 marks)*

(iii) The apparent power *(1 mark)*

(iv) The power factor *(2 marks)*

QUESTION FIVE **(20 *marks*)**

Assume that the switch S in Fig.Q5 has been open for a long time. At time $t = 0$ it is closed.

(a) Obtain equations for $v_C(t)$ and $i(t)$ and sketch them. *(16 marks)*

(b) Use your equations to evaluate $v_C(t)$ and $i(t)$ at the instant when the capacitor voltage is 9 V. *(4 marks)*

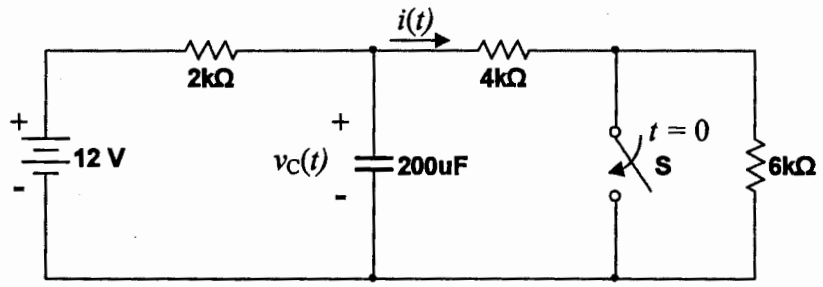

Fig.Q5

QUESTION SIX **(20 *marks)***

Using mesh analysis or otherwise find the voltages at nodes A, B, C and D in the circuit shown in Fig.Q6.

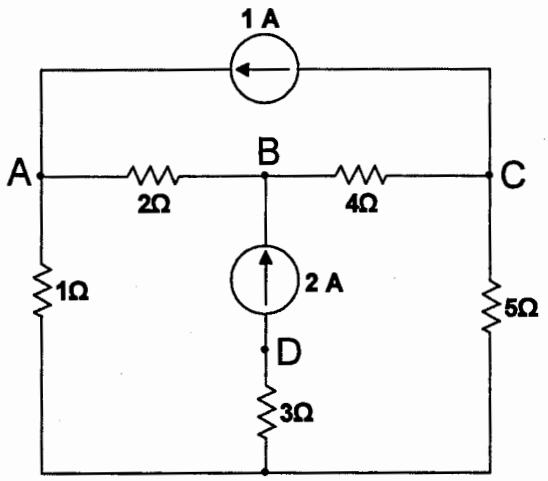

Fig.Q6

QUESTION SEVEN **(20 *marks*)**

(a) For the circuit shown in Fig.Q7a, find the current in the 4 Ω resistor. *(10 marks)*

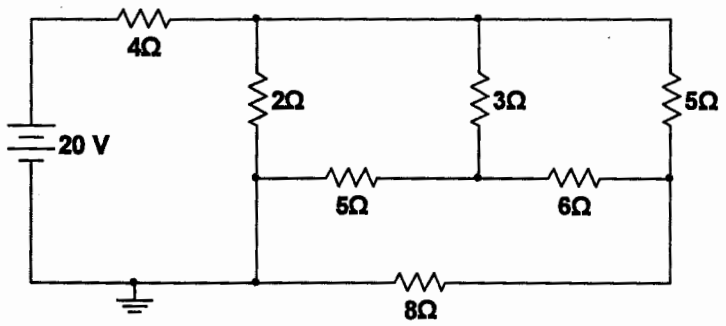

Fig. Q.7a

(b) Three loads each of resistance 3 Ω and inductive reactance 4 Ω in series are connected in star. Find the equivalent loads connected in delta that would represent the star-connected loads. *(10 marks)*