Strathmore
UNIVERSITY

SCHOOL OF COMPUTING AND ENGINEERING SCIENCES
BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING
2nd SEMESTER 2020/2021 - UNIVERSITY EXAMINATION
BEE 1201: CIRCUIT THEORY I

DATE: 9th November, 2021 Time: 3:30pm – 5.30pm

Instructions

1. This examination consists of **FOUR** questions.
2. Answer **QUESTION ONE** and any other **TWO QUESTIONS.**
3. One pocket calculator per-student is allowed as long it is used in "exam-mode".
4. **All other electronic devices are to be kept at a distance and shutdown in your bags.**

Question 1 (30 Marks)

(a) For the circuit shown in Fig. Q1(a), use source transformations to determine the current i_o

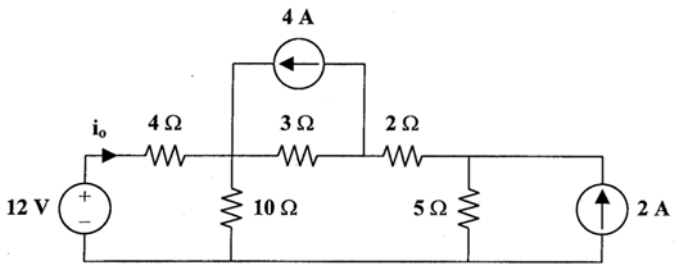

Fig. Q1(a) **(6 Marks)**

(b) For the circuit shown in Fig. Q1(b), find the step responses v(t) to $v_s = 5u(t)$ V assuming the capacitor has no charge at t = 0.

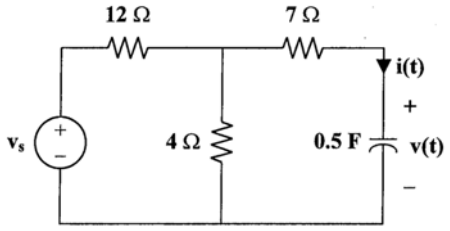

Fig. Q1(b) **(6 Marks)**

(c) Let $A = 10\angle 40^0$ and $B = 8\angle -30^0$. Evaluate the following and express your answer in polar form.

(i) $(A+B)A^*$ **(3 Marks)**

(ii) (A-B)/A **(3 Marks)**

(d) Given the circuit shown in Fig. Q1(d) where $i_s(t) = 5\sin(1000t)$, find the steady state values of $v_c(t)$ and $v_s(t)$.

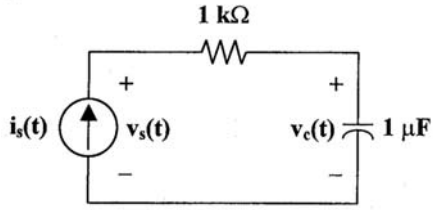

Fig. Q1(d) **(6 Marks)**

(e) A relay coil is connected to a 240V, 50Hz supply. If it has a resistance of 30Ω and an inductance of 0.5H, calculate the real power it consumes, apparent power and power factor.

(6 Marks)

Question 2 (15 Marks)

(a) Assuming an ideal op amp in the circuit shown in Fig. Q2(a), express V_{out} in terms of V_1 and V_2

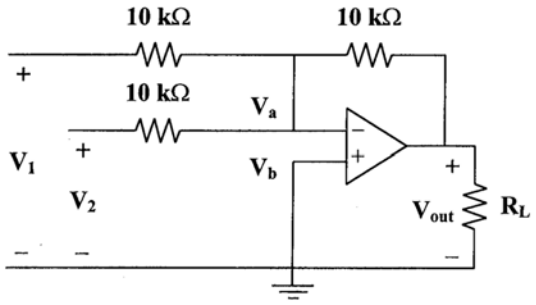

Fig. Q2(a) **(5 Marks)**

(b) Given the circuit shown in Fig. Q2(b), use mesh analysis to find I_x

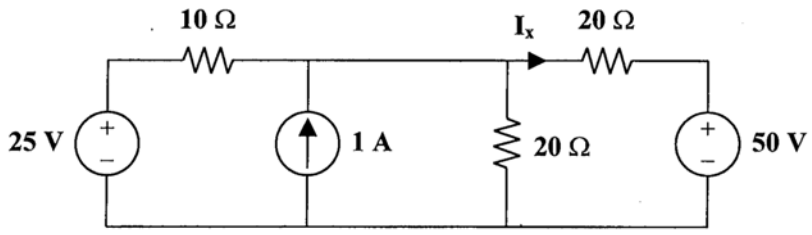

Fig. Q2(b) **(10 Marks)**

Question 3 (15 Marks)

(a) For the circuit shown in Fig. Q3(a), find the values of source resistance R_S and load resistance R_L that will result in maximum power transfer to the load. For these values of R_S and R_L, what is the maximum power delivered to the load R_L.

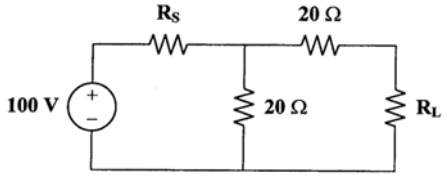

Fig. Q3(a) **(5 Marks)**

(b) Use nodal analysis to find V_x in the circuit shown in Fig. Q3(b)

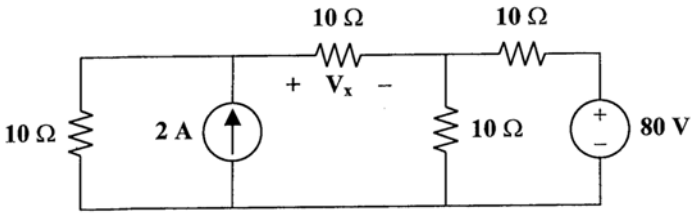

Fig. 3(b) **(10 Marks)**

Question 4 (15 Marks)

(a) Fig. Q4(a) shows an unbalanced wye connected resistors supplied from a balanced wye connected source of 415.69V line to line voltage. Calculate the power delivered to each resistor.

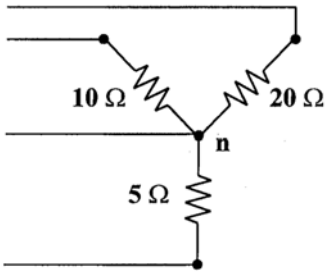

Fig. Q4(a) **(5 Marks)**

(b) Given the circuit shown in Fig. Q4(b) where $v_i(t) = 10\cos(1000t)$, find $v_o(t)$.

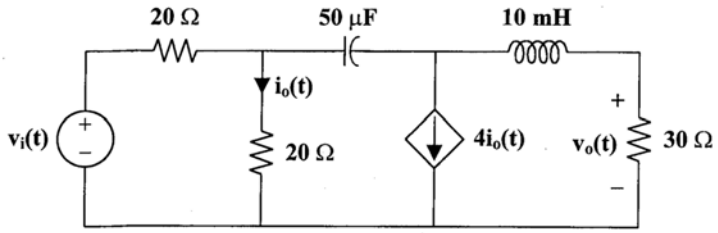

Fig. Q4(b) **(10 Marks)**