Strathmore
UNIVERSITY

SCHOOL OF COMPUTING AND ENGINEERING SCIENCES
BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING
2nd SEMESTER 2021/2022 - UNIVERSITY EXAMINATION
BEE 1201: CIRCUIT THEORY I

DATE: 21st March 2022 Time: 3:30pm – 6.30pm

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 the superposition theorem to find the voltage v_o

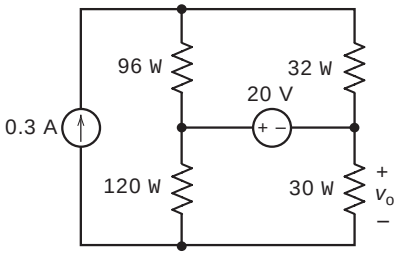

Fig. Q1(a) 6 Marks

(b) For the circuit shown in Fig. Q1(b), assuming an ideal op-amp, find v_o and i_o

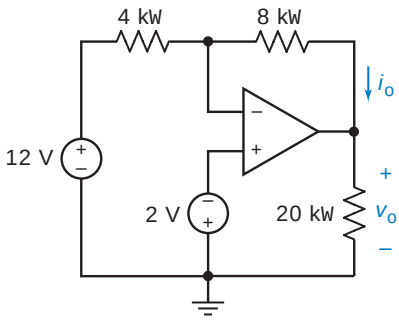

Fig. Q1(b) 6 Marks

(c) The circuit shown in Fig. Q1(c) is at steady state before the switch closes at time $t = 0$.
Determine the capacitor voltage, $v(t)$, for $t \geq 0$.

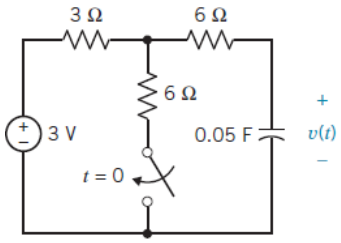

Fig. Q1(c) 6 Marks

(d) Given the circuit shown in Fig. Q1(e) where $i_s(t) = 10\cos(1000t)$, assuming steady state values, find $v_s(t)$ and $v_c(t)$

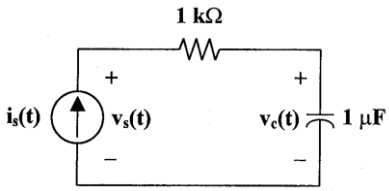

Fig. Q1(d) 6 Marks

(e) A relay coil shown circuit in Fig. Q1(e) is connected to a 240V, 50Hz supply. Calculate the power consumed by the 30Ω resistor, apparent power supplied by the source and the power factor.

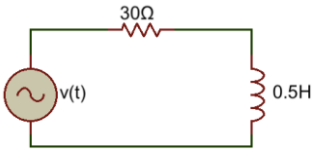

Fig. Q1(e) 6 Marks

Question 2 (15 Marks)

(a) Find the Norton equivalent circuit for the circuit shown in Fig. Q2(a)

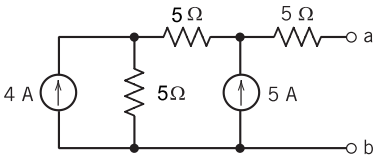

Fig. Q2(a) 5 Marks

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

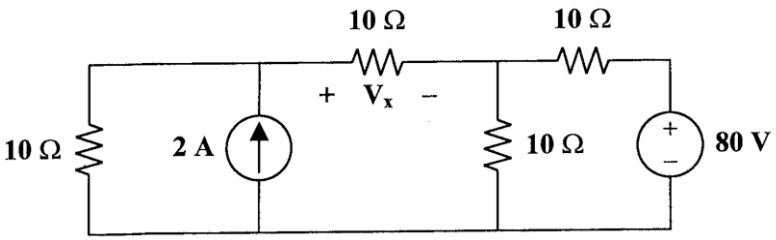

Fig. Q2(b) 10 Marks

Question 3 (15 Marks)

(a) For the circuit shown in Fig. Q3(a), find the values of source resistance load resistance R_L that will result in maximum power transfer. For this value of R_L, find the maximum power.

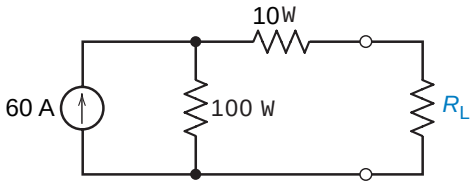

Fig. Q3(a) 5 Marks

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

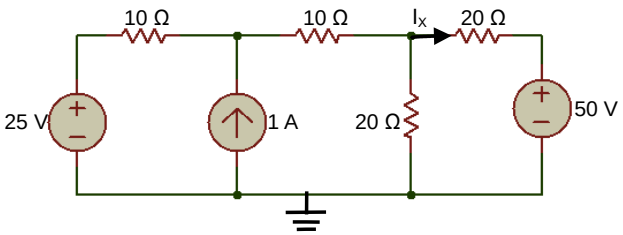

Fig. 3(b) 10 Marks

Question 4 (15 Marks)

(a) Fig. Q4(a) shows an unbalanced wye connected resistors supplied from a balanced wye connected 3 phase source having 415.69V line to line voltage. Calculate the power delivered to each resistor.

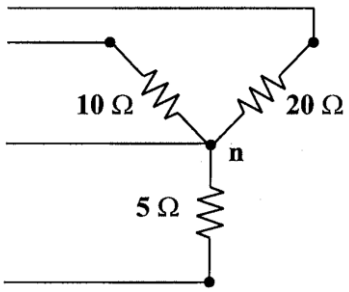

Fig. Q4(a) 3 Marks

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

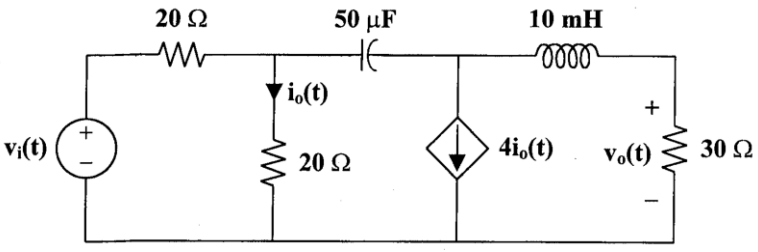

Fig. Q4(b) 12 Marks