(University of Choice)

# MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

## UNIVERSITY EXAMINATIONS

## 2022/2023 ACADEMIC YEAR

## FIRST YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE

OF

BSC IN COMPUTER SCIENCE/ INFORMATION TECHNOLOGY

**COURSE CODE:** BCS 116/ BIT 114

**COURSE TITLE:** ELECTRICAL PRINCIPLES

**DATE:** 20/12/2022 **TIME:** 08:00-10:00AM

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**INSTRUCTIONS TO CANDIDATES**

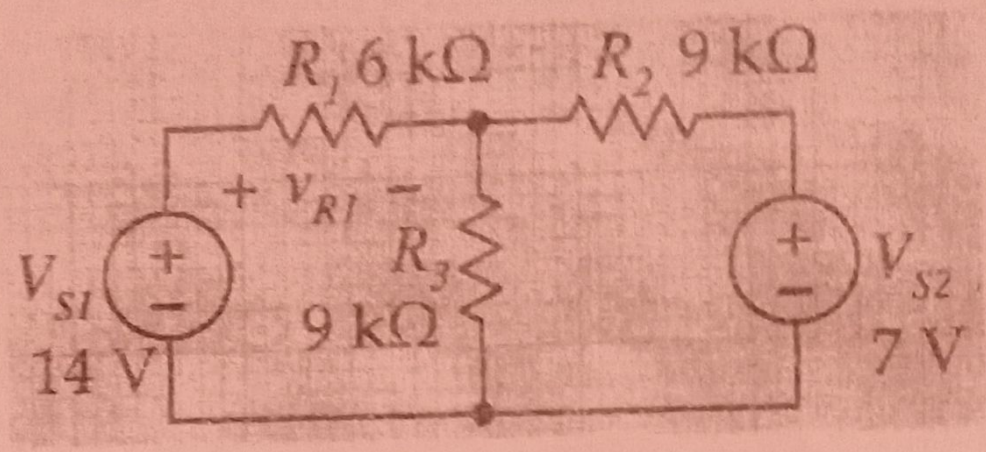
- Answer Questions ONE and ANY OTHER TWO.

TIME: 2 Hours

**QUESTION ONE 30 MARKS (COMPULSORY)**

a. State superposition theorem. **2 Mark**

b. For the circuit shown, use superposition to find the value of $V_{R1}$. **6 Marks**




c. Identify three factors affecting the value of capacitance and briefly explain how they do affect the capacitance **3 Marks**

d. Define the following terms **6 Marks**

i. Conductance
ii. Impedance
iii. Reactance
iv. Resonance

e. State Norton's theorem and by use of an appropriate diagram explain its application in electrical circuit analysis. **6 Marks**

f. Apply both KVL and KCL to each of the two circuits depicted in *Figure 1a & 1b below* to obtain equations for each of the two circuits by applying KCL and KVL. **7 Marks**

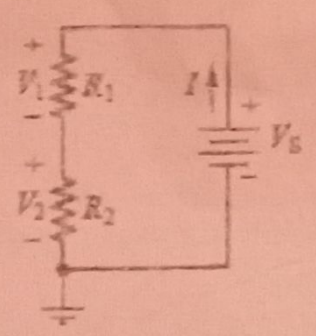


Fig. 1a

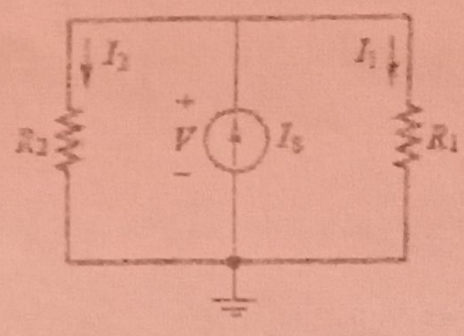
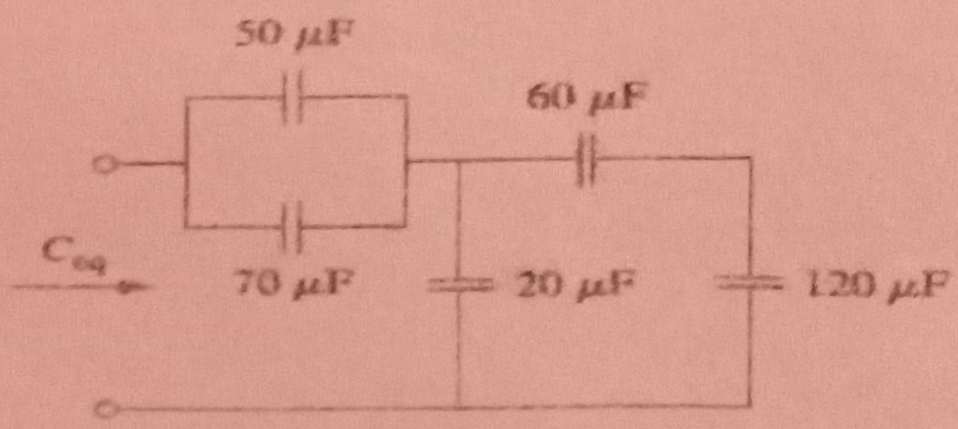


Fig. 1b

**QUESTION TWO 20 MARKS**

a. Find $C_{eq}$ in figure below. Clearly show your working and reasoning. **6 Marks**



b. A metallic conductor has a resistivity of $18 \times 10^{-6}$ Ω·m. What is the resistance of a piece that is 30 m long and has a uniform cross-sectional area of 3.0 $mm^2$? **4 Marks**

c. For a 12 Vrms and 60 Hz power source hooked up in series to a 0.05 H inductor, 5 Ω resistor, and 0.01 F capacitor. Determine the following

i. Circuit Impedance (Z) **4 Marks**

ii. Circuit Resonance frequency (fo) **3 Marks**

iii. Phase Angle (Ø) **3 Marks**

## QUESTION THREE 20 MARKS

a. State Thevenin theorem and by use of diagram(s), explain its application in electrical circuit analysis. **6 Marks**

b. Explain the operation of a parallel circuit, hence from first principles prove that in a parallel circuit for the three resistors $R_1$, $R_2$, and $R_3$, the resistance ($R_{eff}$) is given by $R_{eff} = R_1R_2R_3/(R_1R_2+R_2R_3+R_3R_1)$ **6 Marks**

c. The voltage applied to a series RLC circuit is 0.85V. The Q of the inductor coil is 50 and the value of the capacitor is 320 pF. The resonant frequency of the circuit is 175 KHz. Find:

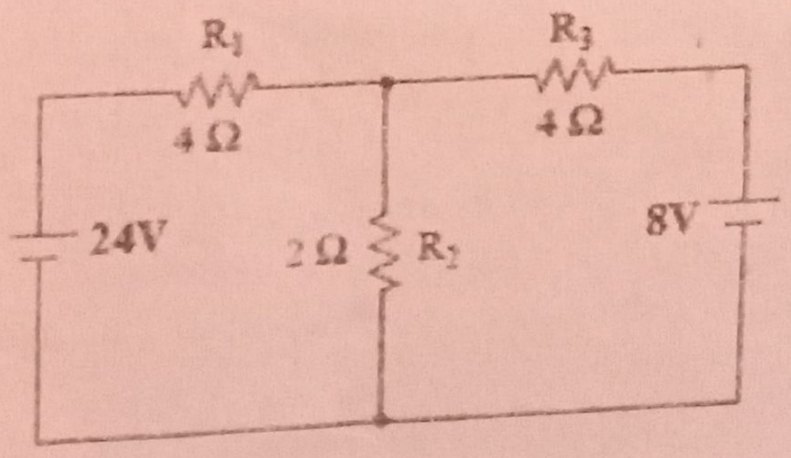
(i) the value of inductance

(ii) the value of resistance

*(iii) the voltage across capacitor* **8 Marks**

## QUESTION FOUR 20 MARKS

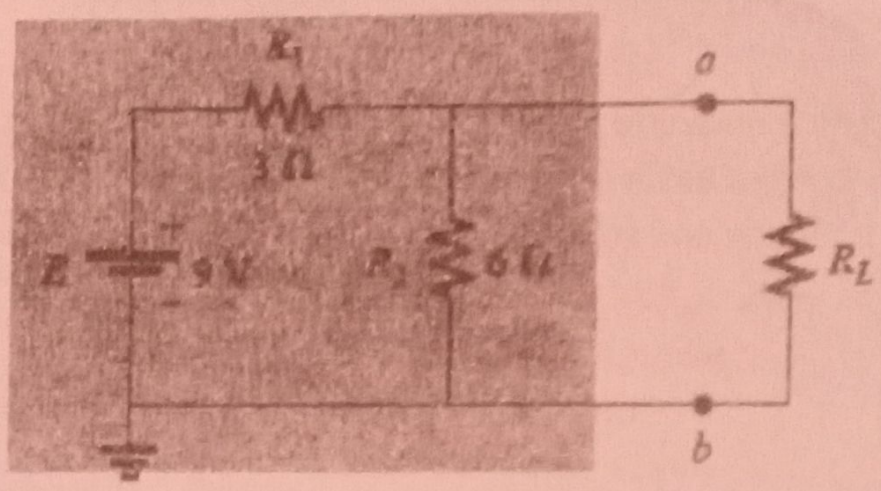
a. In the network shown in the figure below, find the magnitude and direction of the current passing through R2 using Thevenin theorem. **7 Marks**



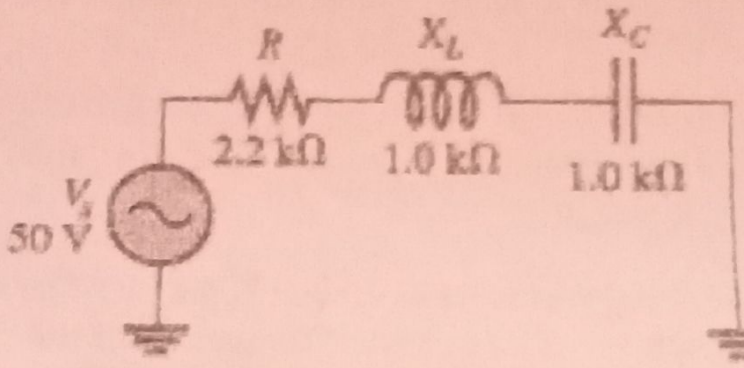

**2 Marks**

b. State Norton's theorem.

c. Find the Norton equivalent circuit for the network in the shaded area of the figure shown below. **5 Marks**




d. Find I, $V_R$, $V_L$ and $V_C$ at resonance in the figure below. The resonant values of $X_L$ and $X_C$ are shown in the figure. **6 Marks**




## QUESTION FIVE 20 MARKS

a. A waxed paper capacitor has two parallel plates, each of effective area 800cm2. If the capacitance of the capacitor is 4425 pF determine the effective thickness of the paper if its relative permittivity is 2.5 **5 Marks**

b. Determine the p.d. across a 4 μF capacitor when charged with 5 mC **3 Marks**

c. Find the charge on a 50 pF capacitor when the voltage applied to it is 2 kV **3 Marks**

d. A series RLC circuit with L =160 mH , C = 100 μF, and R = 40.0Ω is connected to a sinusoidal voltage V (t) = (40.0V)sin(ωt) , with ω = 200 rad/s. **9 Marks**

i. What is the impedance of the circuit?

ii. Let the current at any instant in the circuit be $I(t) = I_0 \sin(\omega t - \varphi)$ . Find $I_0$.

iii. What is the phase constant φ?