MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR
SECOND YEAR SECOND SEMESTER

SCHOOL OF SCIENCE
BACHELOR OF EDUCATION SCIENCE AND BACHELOR OF SCIENCE PHYSICS.

COURSE CODE: PHY 2213-1
COURSE TITLE: ELECTRICAL CIRCUITS.

DATE: 24/4/2023 **TIME: 0830-1030 HRS**

INSTRUCTIONS

- Answer Question ONE and any other TWO.
- Use sketch diagrams where necessary.
- Read instructions on the answer booklet keenly and adhere to them.

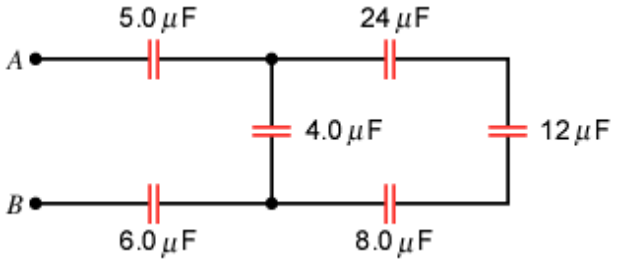
QUESTION ONE ***[20]***

1. Define the following terms giving examples in each:
   - *I. Active elements (1mk)*
   - II. *Passive elements. (1mk)*
   - III. *Linear elements (1mk)*
   - *IV. Reciprocity theorem Statement: (1mk)*
   - *V. Superposition Theorem Statement: (2mks)*
   - *VI. Maximum power transfer theorem. (2mks)*

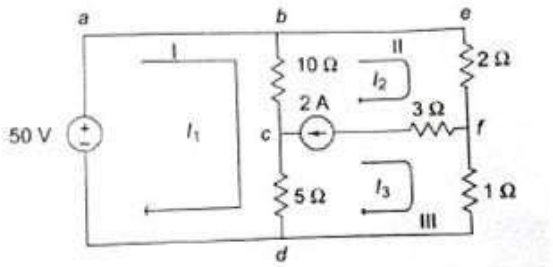
2. The induced voltage in a inductor is given by $V = L\frac{dI}{dt}$.

Show that the energy stored by the inductor is given by $W = \frac{LI^2}{2}$ (3mks).

3. Determine the equivalent capacitance for the circuit shown in figure below. (3mks)



4. Describe super mesh analysis in your own words and use it to write down the mesh equations for the circuit shown in the figure below and calculate the values of the currents I_1, I_2 and I_3 and the current in the 5Ω resistor. *(6mks)*



QUESTION TWO: **[15MKS]**

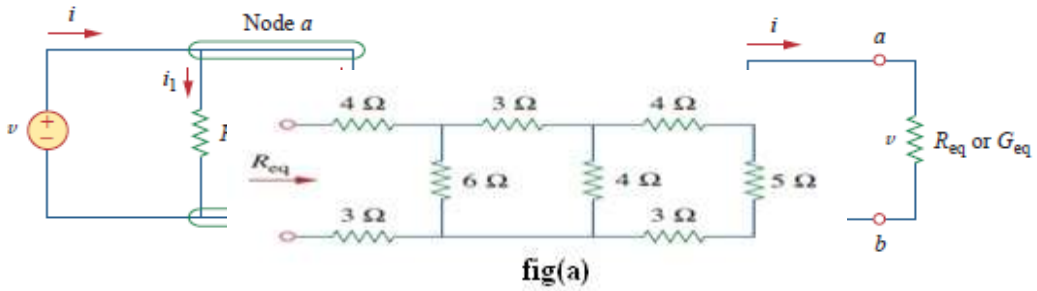
a). Define a Phasor (2mks)

b). Differenciate between Capacitive reactance and Inductive reactance. (2mks).

b). Starting with Ohm's Law and with reference to the following diagram, show that the equivalent conductance is given by: *(6mks)*

$$G_{eq} = G_1 + G_2 + G_3 + \cdots + G_N$$

c). Find the Req for the

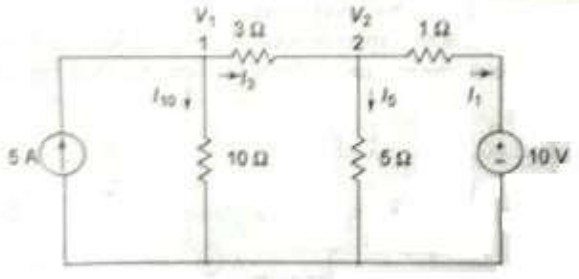


fig(a) fig(a) fig(b)

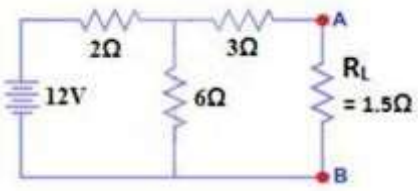
circuit shown in below figure. (5mks).

QUESTION THREE: [15 mks]

a). Write the node voltage equations and find out the currents in each branch of the circuit shown in the figure below using nodal analysis: (6mks)



b). Find the current through the resistance RL (1.5 Ω) of the circuit shown in the figure (a) below using Norton's equivalent circuit. (9 mks)

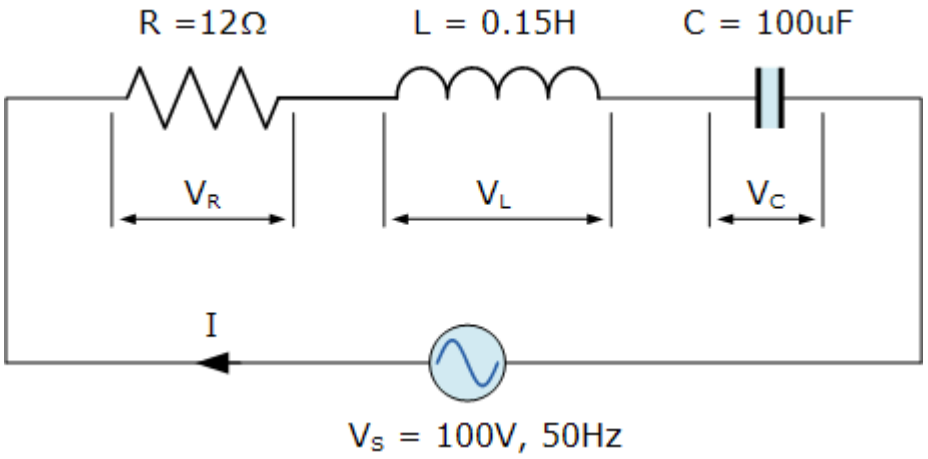


QUESTION FOUR [15MKS]

a). Define the term impedance as used in RLC circuits And state its formula. (3mks)

b). A series RLC circuit containing a resistance of 12Ω, an inductance of 0.15H and a capacitor of 100uF are connected in series across a 100V, 50Hz supply. Calculate the total circuit

impedance, the circuits current, power factor and draw the voltage phasor diagram. (12mks)



//END//