



# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

## UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MEDICAL ENGINEERING

TEE 4232: ELECTRICAL TECHNOLOGY

## SPECIAL/SUPPLEMENTARY EXAMINATION

**SERIES:** SEP 2018

**TIME:** 2 HOURS

**DATE:** SEP 2018

### Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt ANY THREE QUESTIONS.

**Do not write on the question paper.**

### Question ONE

(a)(i).State the following.

(I).Norton's Theorem. (II).Kirchhoff's law.

(ii).Explain effect of circuit mismatch in electronic circuit operations.

**(8 Marks)**

(b)(i).Figure Q1 shows a resistance network connected to two sources of dc power supplies. Calculate the values of current in each resistor using nodal analysis.

(ii).Confirm the value you got for the 15  $\Omega$  using Kirchhoff's current law.

**(12 Marks).**

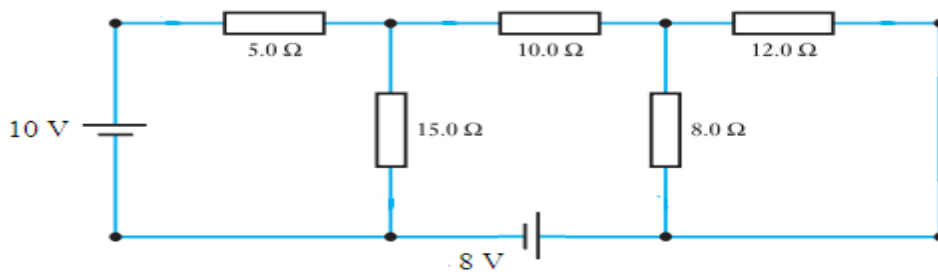


Fig Q1

## Question TWO

(a)(i).State the meaning of the following terms as related to inductance in DC circuits.

(I).Rise Time. (II).coupling efficiency.

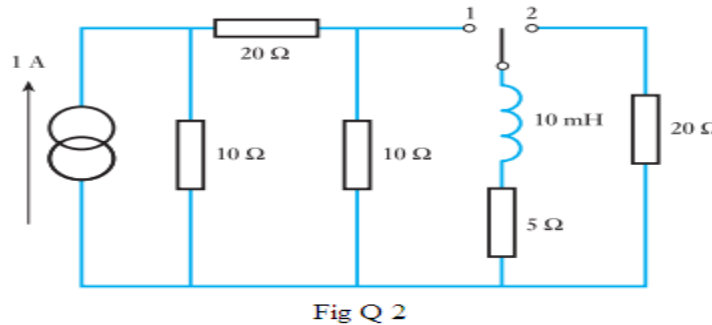
(ii).State lenz's law and explain how it assist in AC transformer action.

**(10 Marks).**

(b)(i).With the aid of a diagram explain the mutual inductance phenomenon inductive circuits.

(ii).For the circuit of figure Q2, the switch is closed to position 1 when time  $t = 0$  seconds and then moved to position 2 1 when time  $t = 1.5\text{mS}$ .Determine the current in the inductor when time has risen to  $2.5 \text{ mS}$

**(10 Marks).**



## Question THREE

(a) (i).Define the meaning of circuit impedance, hence explain the behavioral difference capacitive and inductive reactance.

(ii).State the role of active and reactive powers in motor operation.

(ii).Explain the meaning of oscillatory current in an inductive capacitance circuit and hence state the operation of a series resonance circuit.

**(10 Marks)**

(b)(i).Using the circuit of figure Q 3, explain the phasor voltage construction when the circuit is at resonance.

(ii).A resonating series L-R-C circuit is made of a resistance of  $10 \Omega$ , an inductance of  $3.18\text{m H}$  and a capacitance of  $0.22\mu\text{f}$ . Determine the following.

(I).Circuit impedance and current.

(II).Potential difference across the inductor and capacitance.

(III).The Q-factor of the circuit.

**(10 Marks)**

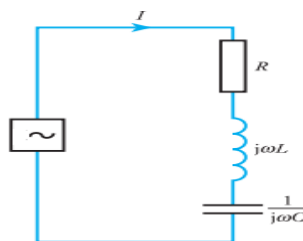


Fig Q 3

### Question FOUR

(a) (i).State the meaning of the following.

(I) Form factor. (II).Instantaneous current.

(ii).Explain the effect of distorted power supply in an electronic circuit.

(7 Marks).

(b)(i).State the difference between 1Ø and 3Ø alternating waveforms, hence explain why it is preferable to use 3Ø power supplies in industries.

(ii).With the aid a diagram explain the representation of a sinusoidal quantity using phasors (10 Marks).

(c).The circuit of figure Q4 is connected to a power supply of 100v at a frequency of 50hz. Calculate, the circuit current and its phase angle. (3 Marks).

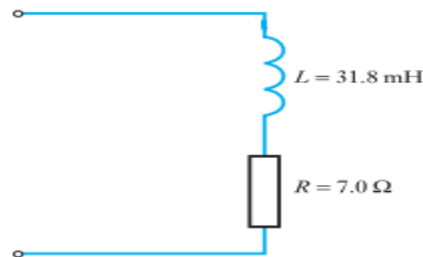


Fig Q 4

### Question FIVE

(a) (i).Define and state the units of the following electromagnetic circuits terms.

(I). Current density (II).Magnetic leakage.

(ii).State any two functions of magnetic fields.

(6 Marks)

(b)(i).With the aid of a diagram, explain how a magnetization curve for a steel ring can be obtained.

(ii).Figure Q 5 shows a magnetic circuit with a dc magneto motive force source at the centre. The center limb has a cross sectional area of  $1600 \text{ mm}^2$  while those of the sides has an area of  $1000 \text{ mm}^2$ . The air gap has a length of 1.5 mm. If the centre limb has a coil of 400 turns, calculate the current value required to form a flux of  $1000 \mu\text{W}$  through the airgap.

(Take the permeability of free space to be  $4\pi \times 10^{-7} \text{ H/m}$ .)

(14 Marks)

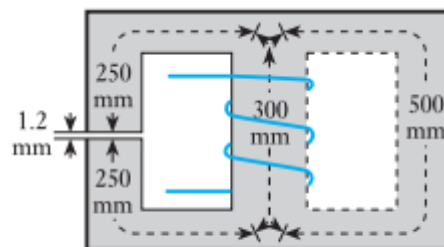


Fig Q 5