PP2

TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT MECHANICAL AND AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN MECHANICAL AND AUTOMOTIVE ENGINEERING

TEE 1211: PRINCIPLES OF ELECTRICAL TECHNOLOGY

END OF SEMESTER EXAMINATION (PAPER 2)

SERIES: MARCH, 2025

TIME: 2 HOURS

DATE: MARCH, 2025

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 QUESTION ONE and any other TWO QUESTIONS

Do not write on the question paper.

Question ONE (Compulsory)

(a) (i) State TWO energy sources and discuss them

(ii) Discuss generation of Electrical power **(10 marks)**

(b) Describe the following terms as applied in electrical technology and state their units of measurement.

(i) Admittance

(ii) Impedance

(iii) Conductance

(iv) Resistance

(v) Power factor **(10 marks)**

(c) A coil of copper wire has a resistance of 100Ω when its temperature is 0^{o} C. Determine its resistance at 70^{o} C if the temperature coefficient of resistance of copper at 0^{o} C is $0.0043/^{o}$C . **(3 marks)**

(d) Consider the circuit of Fig.Q1. Calculate:

(i) The voltage drop across the 1.6 Ω resistor

(ii) The current through the 5Ω resistor

(iii) The power developed in the 1.5Ω resistor **(7 marks)**

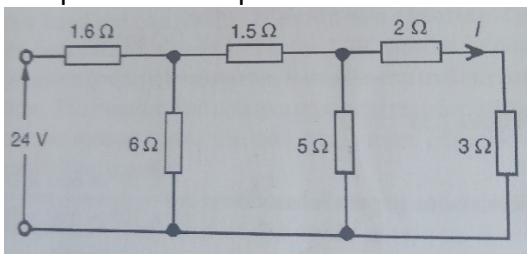

Fig.Q1

QUESTION TWO

(a) Differentiate the following terms as applied in Electrical Technology, stating their units of measurement.

(i) Permittivity of free space
(ii) Electric flux density
(iii) Dielectric material
(iv) Relative permittivity of free space **(10 marks)**

(b) Capacitance of 1μF, 3μF, 5μF and 6μF are connected in parallel to a direct voltage supply of 100V: Determine:

(i) The equivalent circuit capacitance
(ii) The total charge
(iii) The charge on each capacitor **(10 marks)**

QUESTION THREE

(a) (i) State the maximum power transfer theorem

(ii) The circuit diagram of Fig.Q3 shows dry cells of source e.m.f 6V, and an internal resistance 2.5Ω. If the load resistance R_L is varied from 0 to 5Ω in 0.5Ω steps, calculate the power dissipated by the load in each case. Plot a graph of R_L (horizontally) against power (vertically) and determine the maximum power dissipated. **(15 marks)**

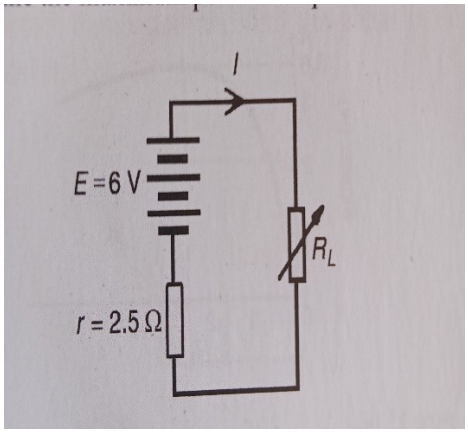

Fig.Q3

(b) Use Kirchhoff's laws to find the current flowing in the 6Ω resistor of Fig. Q3(b) and the power dissipated in the 4Ω resistor. **(5 marks)**

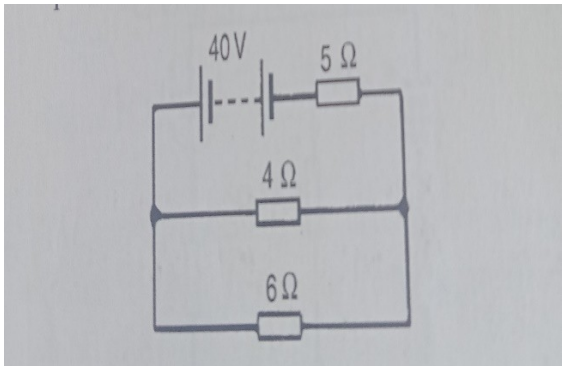

Fig. 3(b)

QUESTION FOUR

(a) Describe the following terms:

(i) Admittance

(ii) Conductance

(iii) Susceptance **(5 marks)**

(b) For the circuit of Fig. Q4, determine:

(i) The equivalent series circuit impedance

(ii) The supply current I

(iii) The circuit phase angle

(iv) The value of voltages V_1 and V_2

(v) The values of currents I_A and I_B **(15 marks)**

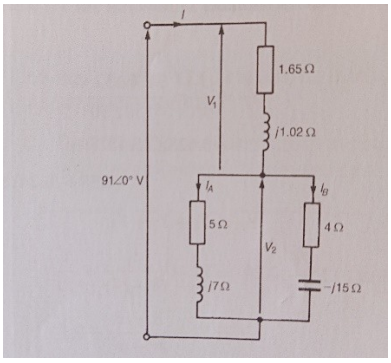

Fig.Q4

QUESTION FIVE

(a) The total impedance Z_T of an electrical circuit is given by

$Z_T = Z_1$ $Z_{T=¿Z_1+\frac{Z_1.Z_3}{Z_2+Z_3}¿.}$

Determine Z_T in polar form correct to 3 significant figures, when

Z_1=5.5<-21° Ω

Z_2=2.6<30° Ω

Z_1=4.8<71° Ω **(8 marks)**

(b) Determine the values of the resistance and the series connected inductances or capacitance of each of the following impedances:

(i) (12+j5) Ω

(ii) -j40 Ω

(iii) 30<60° Ω

(iv) $2.2x10^6$<-30° Ω

Assume for each a frequency of 50Hz. **(12 marks)**