



MACHAKOS UNIVERSITY

University Examinations for 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EMM 209: ELECTRICAL ENGINEERING PRINCIPLE-I

DATE:

TIME:

INSTRUCTIONS

This paper consists of FIVE Questions.

Answer Question ONE [30 Marks] and any other TWO Questions [20 Marks Each].

Write your college number on the answer sheet.

This paper consists of 3 printed pages

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

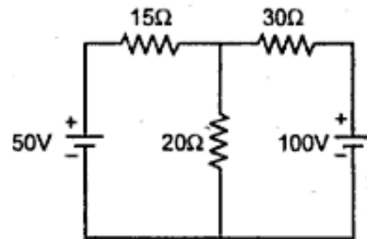
QUESTION ONE [30MARKS]

- a) Define the following: [2Marks]
i. KCL & KVL
- b) State the characteristics of both parallel and series circuits. [6Marks]
- c) Explain the steps applied in Thevenin's circuits. [3Marks]
- d) A pole having strength of $0.8 \times 10^{-3} \text{ Wb}$ is placed in a magnetic field at a distance of 25cm from another pole. It is experiencing a force of 0.75N. Assume constant of medium $\left(\frac{1}{36\pi^2 \times 10^{-7}}\right)$. Determine, [3Marks]
i. Magnetic field strength at the point
ii. The strength of other pole
iii. Distance at which force experience will be doubled.
- e) A parallel plate capacitor has an area of 20 cm^2 , and potential gradient is 10KV/cm and distance between the plates is 2.5mm. The dielectric used between the plates has relative permittivity of 5. Determine the capacitance of the parallel plate; the voltage across the plate; charge; electric flux density and electric flux between the plates. [5Marks].
- f) Outline the advantages of three phase power supply over a single phase supply. [2Marks]

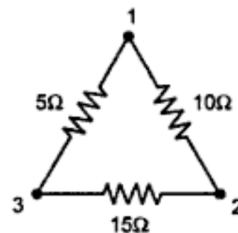
- g) Three identical choke coil are connected as delta load to a three phase supply. The line current drawn from the supply is 10A and total power consumed is 60KW. The KVA input to the load is 10KVA. Find out: [7Marks]
- Line and phase voltage;
 - Impedance /phase;
 - Reactance/phase;
 - Resistance/phase;
 - power factor ;
 - Phase current;
 - Inductance(if frequency is 50Hz)/phase
- h) Explain briefly the three requirement of analog indicating instruments. [3Marks]

QUESTION TWO [20 MARKS]

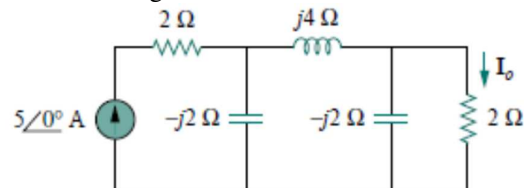
- a) For the circuit given below, apply both KCL and KVL. [5Marks]



- b) Deduces an expression of delta to wye connection hence convert the given delta to its equivalent star circuit. [8Marks]

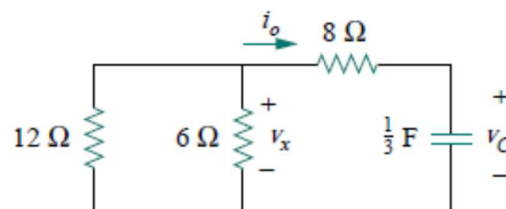


- c) Solve for I_o in the below circuit using Thevenin's theorem. [7Marks]



QUESTION THREE [20 MARKS]

- a) Deduce an expression of source free RC circuit hence solve for V_C , V_X and I_o in the circuit given below. [9Marks]

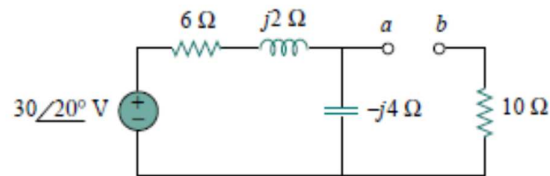


- b) An iron ring of circular cross sectional of 4.0cm^2 and mean diameter of 10cm is wound with 500 turns of wire and carries a current of 2A to produce the magnetic flux of 0.75m Wb in the ring, Determine the permeability of the material. [3Marks]

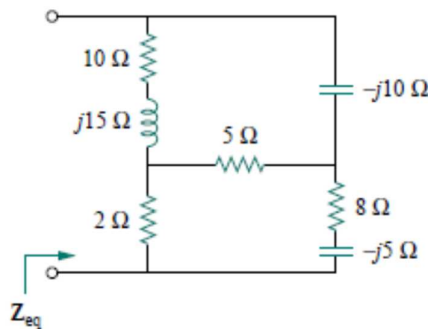
- c) An iron ring 6cm, mean diameter is made up of round iron of diameter 1cm and permeability of 800, has an air gap of 2.5mm wide. It consist of winding with 350 turns carrying a current of 3A .Determine; [8Marks]
- m.m.f
 - Total reluctance
 - The flux
 - Flux density in ring

QUESTION FOUR [20MARKS]

- a) Three inductive coil each having resistance of 20 ohm and reactance of 15 ohm are connected in star across a 420v, three phase 50Hz supply. [7Marks]
- Calculate:
- Line voltage
 - Phase voltage
 - Line current
 - Phase current
 - Power factor
 - Power absorbed
 - Draw phasor diagram
- b) Obtain the Thevenin for the circuit given below at terminal a-b. [8Marks]

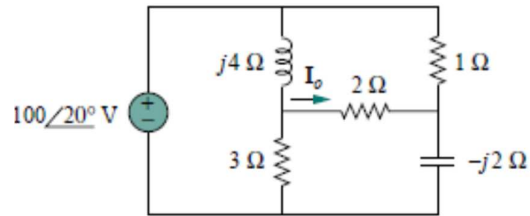


- c) Determine the impedance of the circuit given below when $\omega = 10\text{rad/s}$. [5Marks]



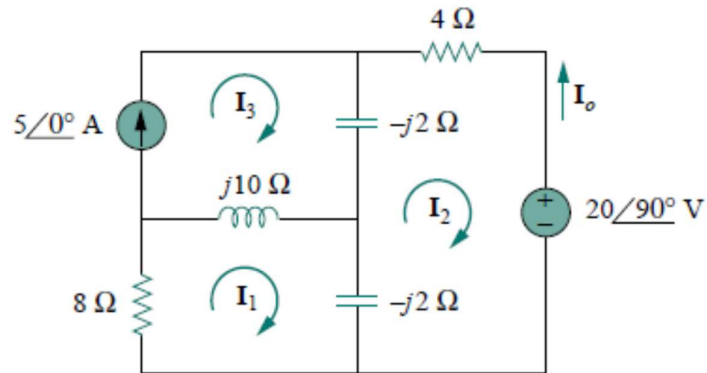
QUESTION FIVE [20MARKS]

- a) Prove that a three phase balanced load draws three times as much power when connected in delta as it would draw when connected in star. [4Marks]
- b) Find the current I in the circuit given below . [4Marks]



- c) Determine the current I_0 using the superposition principle analysis for the circuit given below

[6Marks]



- d) Computer-based instruments are rapidly replacing items of conventional test equipment in many of today's test and measurement applications. Explain the principle of operation of virtual DSO.

[6Marks]