



MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

THIRD YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONIC ENGINEERING)

SPT 202: ELECTRICAL CIRCUITS

DATE:

TIME:

INSTRUCTIONS

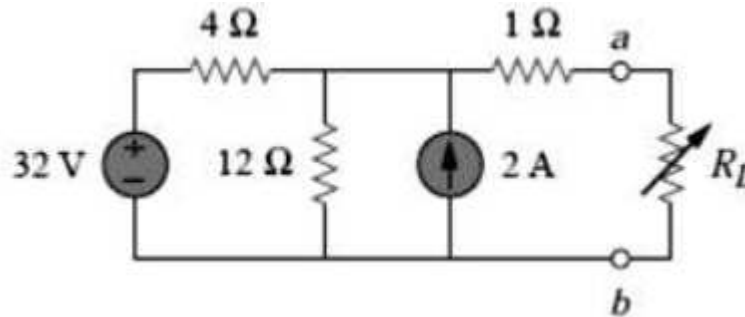
Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) With reference to magnetism, explain
- i) Two types of magnets
 - ii) Two classifications of magnetic materials (4 marks)
- b) With the aid of a diagram, explain the effect of
- i) Current carrying conductor
 - ii) Between a pair of poles (4 marks)
- d) A coil of 400 turns is wound on a material ring with a circumference of 50cm and a cross-sectional area of 5cm^2 . If a current of 10A flows. Determine the;
- i) Magnetic field strength
 - ii) Flux density
 - iii) Magnetic flux (6 marks)
- e) Each phase of a delta-connected load comprises a resistance of $40\ \Omega$ and a $40\ \mu\text{F}$ capacitor in series. Determine, when connected to a 415 V, 50 Hz, 3-phase supply
- (i) the phase current,

- (ii) the line current,
- (iii) the total power dissipated, (6 marks)

f) Using the Thevins theorem, Determine the current through the load resistor in figure below



6mks

QUESTION TWO (20 MARKS)

- a) State
 - i) Lenz's law
 - ii) Flemings Right hand rule (4 marks)
- b) Define the terms
 - i) Relative permeability
 - ii) Absolute permeability (4 marks)
- c) A closed magnetic circuit of cast steel has 8cm long path of crosssectional area 2cm^2 and 4cm path of crosssectional area 1cm^2 . a coil of 400 turns is wound on the 8cm length and a current of 0.5A flows.

Determine the;

 - i) Total reluctance
 - ii) Flux density in 4cm path use relative permeability of 800. (6 marks)
- d) A coil of inductance 160mH and resistance 50Ω is connected in parallel with a $40\mu\text{F}$ capacitor across 240v, 50Hz supply

Determine the:

 - i) Current in the coil and its phase angle
 - ii) Supply current and phase angle

iii) Apparent power (6 marks)

QUESTION THREE (20 MARKS)

a) i) State four factors which determine the magnitude of force in a current carrying conductor.

(6 marks)

ii) Highlight 4 factors which determine the value of inductance in a coil

(6 marks)

b) A flux of 30mwb links with a 2000 turns of coil when a current of 5A flows;

Determine the;

i) Inductance of the coil

ii) Energy stored

iii) Induced emf ,If the current changes after 100 seconds

(6 marks)

c) 2 coils are connected in series aiding of inductance 300mH and 400mH

Determine

i) Total inductance

ii) Mutual inductance

(2 marks)

QUESTION FOUR (20 MARKS)

a) i) Explain the terms reactive and active power in A.C. circuits (2 marks)

ii) A coil of resistance 5Ω and inductance 120mH in series with a $200\mu\text{F}$ capacitor is connected in series v to a 300v, 50Hz supply

Calculate i) Current flowing in the circuit

ii) Phase difference

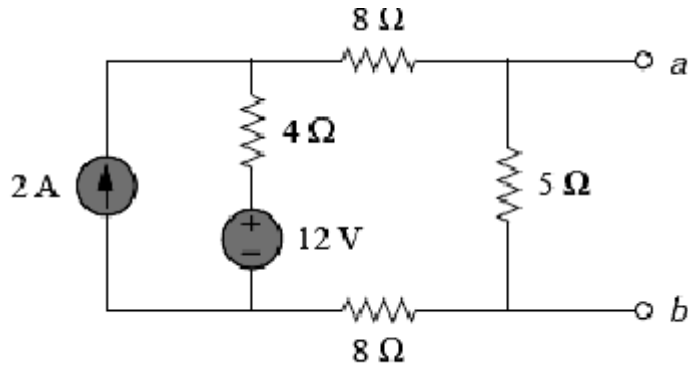
(6 marks)

b) i) State any Three advantages of three phase systems

ii) Three identical capacitors are connected (a) in star, (b) in delta to a 400 V, 50 Hz, 3-phase supply. If the line current is 12 A, Determine in each case the capacitance of each of the capacitors.

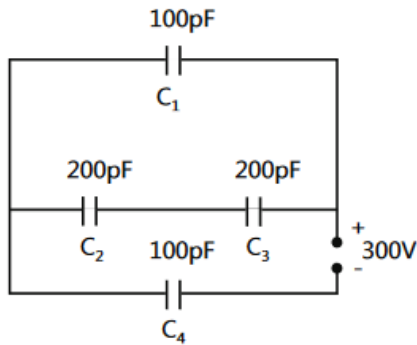
(8 marks)

c) Determine the Norton's equivalent of figure 2 below



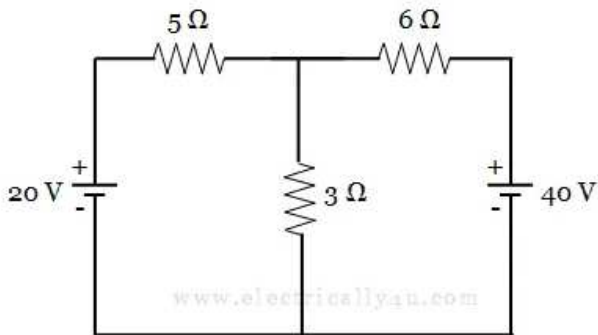
QUESTION FIVE (20 MARKS)

- a) i) Define the terms Electric field and charge
 ii) Obtain the equivalent capacitance of the network in figure 3 . For a 300V supply, determine the charge and voltage across each capacitor.



(10 marks)

- b) i) State the superposition theorem
 ii) Using the superposition theorem determine the current through the 3 Ω resistor



(10 marks)