



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

CERTIFICATE IN MECHANICAL AND AUTOMOTIVE ENGINEERING

2502/102: ELETRICAL PRINCIPLES (TIVET)

DATE: 25/4/2019

TIME: 8.30-11.30 AM

INSTRUCTIONS:

Instructions: answer question one and any other two questions

QUESTION ONE (30 MARKS)

- a) give the equivalence of the following magnetic parameters to their electric equivalence
- i. Flux
 - ii. Reluctance
 - iii. Flux density
 - iv. Magnetic force (5 marks)
- b) state the two faradies laws of electromagnetic induction. (2 marks)
- c) define the following
- i. reluctance
 - ii. permeance
 - iii. magnetomotive force
 - iv. show that the energy stored in a capacitor is given by

$$\frac{1}{2} CV^2 \quad (8 \text{ marks})$$

the magnetic susceptibility of oxygen gas at 20°C is 167×10^{-11} H/m. Calculate its absolute and relative permeabilities. (5 marks)

A laminated soft iron ring of relative permeability 1000 has a mean circumference of 800mm and a cross sectional area of 500mm^2 . A radial air gap of 1mm width is cut in the ring which is wound with 1000 turns.

Calculate the current required to produce an air gap flux of 0.5mwb if leakage factor is 1.2 and stacking factor of 0.9. neglect fringing. (10 marks)

QUESTION TWO (20 MARKS)

A 250kVA 1100V/400V, 50Hz single phase transformer has 80 turns on the secondary. Calculate

- a) The approximate values of the primary and secondary currents
- b) The approximate number of primary turns
- c) The maximum value of the flux (20 marks)

QUESTION THREE (20 MARKS)

The maximum values of the alternating voltage and current are 400V and 20A respectively in a circuit connected to 50Hz supply and these quantities are sinusoidal. The instantaneous values of the voltage and current are 283V and 10A respectively at $t=0$ both increasing positively.

- a) Write down the expression for voltage and current at time t ,
- b) Determine the power consumed in the circuit.

QUESTION FOUR (20 MARKS)

An iron rod, 2cm in diameter and 20cm long is bent into a closed ring and is wound with 3000 turns of wire. It is found that when a current of 0.5 A is passed through this coil the flux density in the coil is 0.5wb/m^2 . Assuming that all the flux is linked with every turn of the coil, what is

- a) The B/H ratio for the iron (10 marks)
- b) The inductance of the coil and what voltage would be developed across the coil if the current through the coil is interrupted and the flux in the iron falls to 10% of its former value in 0.001 second (10 marks)