MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING (TVET)

2502/103: ELECTRICAL ENGINEERING PRINCIPLES

DATE: 25/4/2019 **TIME: 8.30-10.30 AM**

INSTRUCTIONS:

ANSWER ALL QUESTIONS

QUESTION ONE (20 MARKS)

a) i State the principle of ac generator

ii With an aid of a labeled constructional diagram describe the components of an a.c generator. (10 marks)

b) A coil of 300 turns is wound uniformly over a wooden ring having a mean circumference of 450mm and a uniform cross-sectional area of 900 mm^2 . If the current through the coil is 4 A. Taking relative permeability of wood is 1 and permeability of free space is $4\pi \times 10^{-7}$ H/m. Calculate the;

i. magneto motive force

ii. magnetic field strength

iii. flux density

iv. total flux

v. reluctance (10 marks)

QUESTION TWO (20 MARKS)

a) i State the two Faraday's induction laws

ii A conductor 250 mm long is carrying current of 8 A. The force on the conductor is 5N. Calculate the density of the field. (6 marks)

b) State four characteristics of lines of magnetic flux. (4 marks)

c) An a.c generator has a coil of 150 turns rotated at 3600 rpm in a magnetic field having a uniform density of 0.05 T, the axis of rotation is at right angles to the direction of the flux. If the mean area per turn is 70 $cm^{2.}$ Calculate the;

i. frequency

ii. periodic time

iii. maximum value of e.m.f generated

iv. generated e.m.f when the coil is rotated through 45^0 from the position of zero e.m.f (10 marks)

QUESTION THREE (20 MARKS)

a) Draw a sinusoidal waveform and indicate the following quantities with reference to alternating systems.

i. peak value

ii. Instantaneous value

iii. period (6 marks)

b) An alternating voltage has an equation V = 150 sin 314t. Determine for this voltage;

i. r.m.s voltage

ii. average voltage

iii. frequency

iv. The instantaneous voltage when t = 0.25 sec (8 marks)

c) Distinguish between ferromagnetic and paramagnetic materials with respect to magnetism. State an example of material in each case. (4 marks)

QUESTION FOUR

a) i State Lenz's Law

ii A magnetic flux of 500microWb passing through a ciol of 1500 turns is reversed in 0.25seconds. Calculate the average value of e.m.f induced in the coil.(5 marks)

b) i Define magnetic hysteresis

ii With an aid of a labeled diagram explain the hysteresis loop (7 marks)

c) A mild-steel ring having a cross-sectional area of 500mm^2 and a mean circumference of 400mm has a coil of 250 turns wound uniformly around it. If the relative permeability of mild-steel is 380, calculate the

i. Reluctance of the ring

ii. Current required to produce a flux of 800microWb in the ring (8 marks)

QUESTION FIVE (20 MARKS)

a) i Define an inductance of one Henry

ii A laminated steel ring is wound with 250 turns. When the magnetizing current varies between 4A and7A, the magnetic flux varies between 750microWb and 800 microWb. Calculate the incremental inductance of the coil over this range of current variation. (5 marks)

b) A magnetic circuit comprises of three parts in series ,each of uniform cross-sectional area (csa). They are;

i. A length of 85mm and csa 50mm^2

ii. A length of 70mm and csa 80mm^2

iii. An air gap of length 0.5mm and csa 100mm^2

A coil of 4000 turns is wound on part (b) and the flux density in the air gap is 0.3T. Assuming that all the flux passes through the given circuit and that the relative permeability is 1200 determine the coil current to produce such a flux density. (8 marks)

c) Distinguish between self inductance and mutual inductance (4 marks)

d) Sketch the symbols for the various types of inductors (3 marks)