TECHNICAL UNIVERISTY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

CERTIFICATE IN MECHANICAL ENGINEERING (Y1, S2)

EEE 1105: ELECTRICAL ENGINEERING SCIENCE II

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2014
TIME: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*
This paper consists of **FIVE** questions. Answer any **THREE** questions
Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

a) What does it mean for a an object to have an electric charge? Give an example of an object receiving an electric charge and describe how that charged object might behave. **(4 marks)**

b) Given two length of a solid metal wire with round cross-sections which one will have the least electrical resistance; one that is small-diameter, or the that is large-diameter? Assume all other factors are equal (same metal type, same wire length, etc) **(3 marks)**

c) Label the direction of both electron flow and convectional flow in this simple circuit: **(3 marks)**

Lamp

d) (i) Show that for four resistors connected in series **(5 marks)**

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

$$R_T = R_1 + R_2 + R_3 + R_4$$

(ii) Show that for four resistors connected in parallel

(5 marks)

Question Two

a) (I) Define the following magnetic quantities:
   (i) Magnetic field
   (ii) Magnetic flux Q
   (iii) Magnetic flux density (B)
   (iv) Magnetomotive force (mmf)
   (v) Reluctance (S) **(5 marks)**

(II) With an aid of sketches describe interaction of magnetic fields on current carrying conductors:
   (i) In the same direction
   (ii) In opposite direction **(8 marks)**

b) (I) A magnetic pole face has a rectangular section having dimensions 200mm by 100mm. If the total flux emerging from the pole is 150μWb, determine the flux density. **(4 marks)**

(II) A flux of 300μ webers passing through a 150 turns coil is reversed in 40ms. Determine the average induced Emf. **(3 marks)**

Question Three

a) Explain the meaning of a series circuit. **(2 marks)**

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b) Two resistors of values 10Ω and 20Ω are connected in parallel with one another, the combination draws a current of 10A from the supply. Calculate:

    (i) Current in each resistor

    (ii) P.D across parallel circuit   **(8 marks)**

c) A battery of e.m.f 48V and internal resistance 3Ω is charged on a 110V d.c. supply0, using the constant current method. If the cost of energy is shs 0.95 per kwh, calculate:

    (i) The series resistance required to give a current of 4A

    (ii) The cost of charge the battery for 18 hours   **(5 marks)**

Question Four

a) (i) State THREE types of single phase motors and explain which type is best to be used in light office work   **(5 marks)**

    (ii) Explain briefly why a single phase motor is not self-starting   **(4 marks)**

b) (i) State how the direction of rotation of a single phase induction motor can be changed.

                                                  (3 marks)

    (ii) With aid of a circuit diagram, explain the principle of operation of a capacitor start single phase induction motor.   **(5 marks)**

c) Explain the term "Slip" in reference to induction motors   **(3 marks)**

Question Five

a) (i) State the losses that occur in a transformer.   **(4 marks)**

    (ii) Explain using a diagram TWO methods by which transformer windings are would around the iron core.   **(8 marks)**

b) (i) State the effect of the losses in transformer when it is on full load   **(4 marks)**

    (ii) Explain briefly the principle of operation for a single phase transformer   **(4 marks)**