**TECHNICAL UNIVERISTY OF MOMBASA**

# Faculty of Engineering & Technology

**DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING**

DIPLOMA IN ELECTRICAL ELECTRONIC ENGINEERING (DEEE 2)

**EEP 2103: ELECTROMAGNETISM II**

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

**Instructions to Candidates:**
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**

**a)** (i) State Faraday's laws of electromagnetic induction.
(ii) Derive the expression for the magnitude of emf induced in a coil moving in a magnetic field.
**(7 marks)**

**b)** With the aid of a well labeled diagram, describe the operation of a simple ac generator.
**(9 marks)**

**c)** The field winding of a 4 pole dc generator consists of 4 coils connected in series each coil being wound with 1500 turns when the field is excited there is a magnetic flux of 0.05 wbl pole. If the field switch is opened at such a speed that the flux falls to the residue value of 0.005wb/pole in 0.25 0.2 second. Calculate the average emf induced across the field winding terminals.
**(4 marks)**

**Question Two**

**a)** (I) State any TWO applications of the mechanical force exerted on a current carrying conductor situated in a magnetic field.
(II) State any TWO factors that influence the magnitude of the force in a coil situated in a magnetic field **(4 marks)**

**b)** (I) With the aid of a well labeled diagram, describe the operation of a moving coil loud speaker.

(II) Determine the direction of the force on the conductor in figure 1(a) and figure 1(b) and state the rule you have used.

Fig 1a

**(12 marks)**

c) (I) A conductor 0.6m long is carrying a current of 50A and is placed in a uniform field of 1.2T. Calculate the force on the conductor if it is placed at $60^{o}$ to the magnetic field.

(II) State the positions for (i) Maximum force (ii) Minimum force **(4 marks)**

**Question Three**

**a)** (I) State any THREE factors that determine the inductance of a coil.

(II) Derive the expression for the energy in an inductor

**b)** Two coils of self inductance 3.4H and 1.4H respectively are connected in series. The coefficient of coupling between the coils is 0.5. Determine the total inductance of the circuit if the windings are connected
**(i)** in series opposing
**(ii)** in series aiding **(15 marks)**

**c)** A coil of resistance 5Ω and inductance 1H is connected to a supply of 60V. Determine:

**(i)** The rate of change of current at the instant of closing the switch

**(ii)** The final steady value of current

**(iii)** The time constant

**(iv)** The time taken for the current to reach 5A **(5 marks)**

**Question Four**

**a)** (i) Determine the resultant force of between two conductors carrying current in the same direction in air.

(ii) Derive the expression for the magnitude of the exerted force between two conductors carrying current in air medium

(iii) Determine the magnitude of the force between two conductor each carrying currents of 15kA in opposite direction. The separation is 10cm and length of the conductor is 1m. **(12 marks)**

**b)** (i) Explain how eddy currents occur in magnetic circuits.

(ii) Explain the methods used to minimize eddy currents. **(5 marks)**

**c)** The field windings of a DC machine consists of eight coils in series containing 1500 turns. When the current in 5A, the flux linked with each coil is 25m wb, calculate:

(i) The inductance

(ii) The energy stored **(3 marks)**

**Question Five**

**a)** State and explain the requirements for the operation of a moving coil instrument. **(6 marks)**

**b)** (i) With the aid of a well labeled diagram, describe the operation of a permanent magnetic moving coil instrument (PMMC)

(ii) Explain how the PMMC instrument may be adapted to measure ac current **(10 marks)**

**c)** A PMMC instrument has a resistance of 5Ω and gives full scale deflection when a current of 5mA passes through it. Calculate the value of the resistance to be used so that the meter may measure:

**(i)** Currents up to 2A

**(ii)** Potential difference up to 10V