TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING (DEEE2)

ELECTROMAGNETISM II

EEP 2104

END OF SEMESTER EXAMINATION

SERIES: MAY 2016

TIME: 2 HOURS

DATE: Pick DateSelect MonthPick Year

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

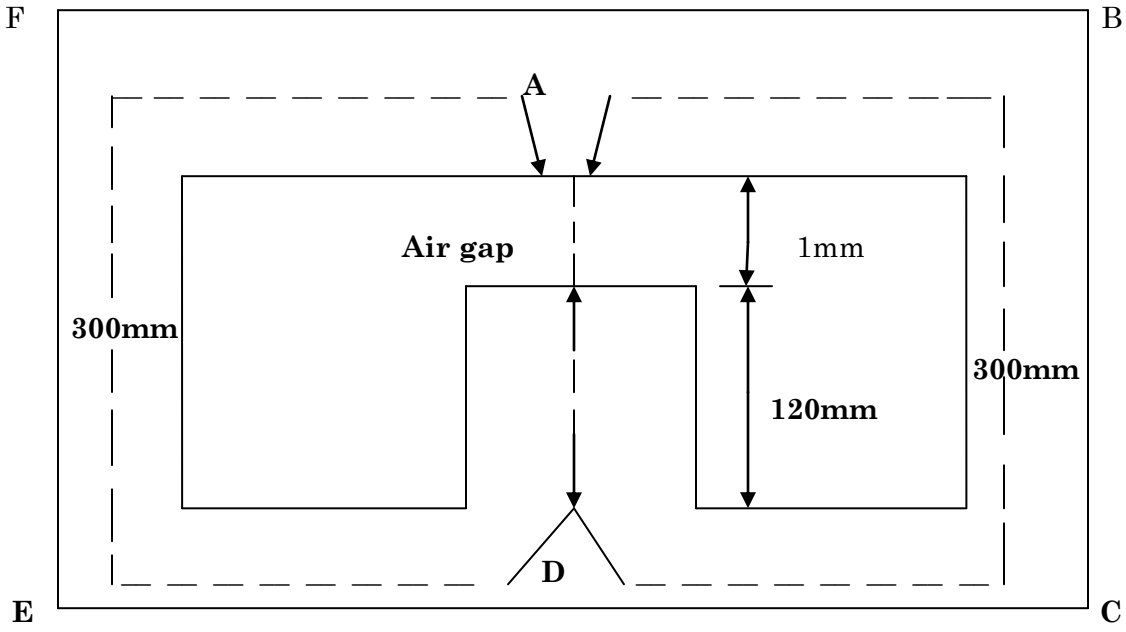
This paper consists of **five** Questions;. Attempt any THREE Questions.

Do not write on the question paper.

QUESTION ONE

a. State Lenz's law. (2 marks)

b. A magnetic circuit made of mild steel is arranged as shown. The central limb is wound with 500 turns and has a cross sectional area of 800mm^2. Each of the outer limbs has a cross sectional area of 500mm^2. The air gap has a length of 1mm, calculate the current required to set up a flux of 1.3mwb in the central limb assuming no magnetic leakage and fringing. Mild steel required 3800AT/m to produce flux density of 1.625T and 850AT/m to produce flux density of 1.3T.
(8 marks)



c. State **three** factors that affect the force on a current carrying conductor. (3 marks)

d. A conductor carries a current of 30mA at a right angle to a magnetic field having a flux density of 12.25T. Calculate the force on the conductor in Newtons per meter length. (3 marks)

e. State **FOUR** comparisons between magnetic circuit and electrical circuit. (4 marks)

QUESTION TWO

a. With the aid of a diagram describe the operation of a loudspeaker. (8 marks)

b. Calculate the force exerted on a charge of $13.5 \times 10^{-18} C$ travelling at 0.25×10^{6} m/s perpendicular to a field of density $0.75 \times 10^{-7} T$. (3 marks)

c. State **three** differences between magnetic and electrical circuits. (3 marks)

d. Draw a diagram of a simple moving coil instrument and explain its operation. (6 marks)

QUESTION THREE

a. Show that the emf induced in a coil is given by:

$e = -N\frac{d\phi}{dt}$ Volt (4 marks)

b. A coil of resistance 120Ω is placed in a magnetic field of 1m Wb. The coil has 100 turns and a galvanometer of 350Ω resistance is connected in series with it. Find the average emf and the current, if the coil is moved in 0.025 seconds from the given field to a field of 0.1mWb. (5 marks)

c. The field coils of a 6 pole dc generator each having 100 turns, are connected in series. When the field is excited, there is a magnetic flux of 0.02Wb/pole. If the field circuit is opened in 0.02 second and residual magnetism is 0.002Wb/pole, calculate the average voltage which is induced across the field terminals. In which direction is this voltage directed relative to direction of current. (4 marks)

d. State Lenz's law. (1 mark)

e. A conductor 1.2m long is carrying a current of 25A and is placed in a magnetic field of uniform flux density of 0.6wb/m^2. Calculate the mechanical force of the conductor when the conductor is placed at:

   a. Right angles to the magnetic field.
   b. 60^0 to the perpendicular to the magnetic field.
   c. Horizontal to the magnetic field. (6 marks)

QUESTION FOUR

a. State the Faradays laws of electromagnetic induction. (2 marks)

b. Show that the energy density of a magnetic field is given by:

$U = \frac{1}{2}\frac{B^2}{\mu_0}$ J/m^3 given $B = \mu_0 nI$ and self inductance $L = \mu_0 n^2 IA$

(5 marks)

c. A solenoid with 1000 turns has a length of 300 mm and a diameter of 10 mm. A current of 0.5 A flows through it and the magnetic field is assumed uniform inside the solenoid. Find the magnetic energy density inside the solenoid. (3 marks)

d. A coil of 150 turns is rotated at 1500r/min in a magnetic field having a uniform density of 0.05T, the axis of rotation being at right angles to the direction of the flux. The mean area per turn is 30cm^2. Calculate :

   i. The frequency.

ii. Period.
iii. The maximum value of the generated emf.
iv. The value of generated emf when the coil has rotated through 60^0 from the position of zero emf. (6 marks)

e. Starting from $e = 2Blusin\theta$, show that maximum emf of a coil of N turns is given by:

$E_m = 2\pi BAnN$ (4 marks)

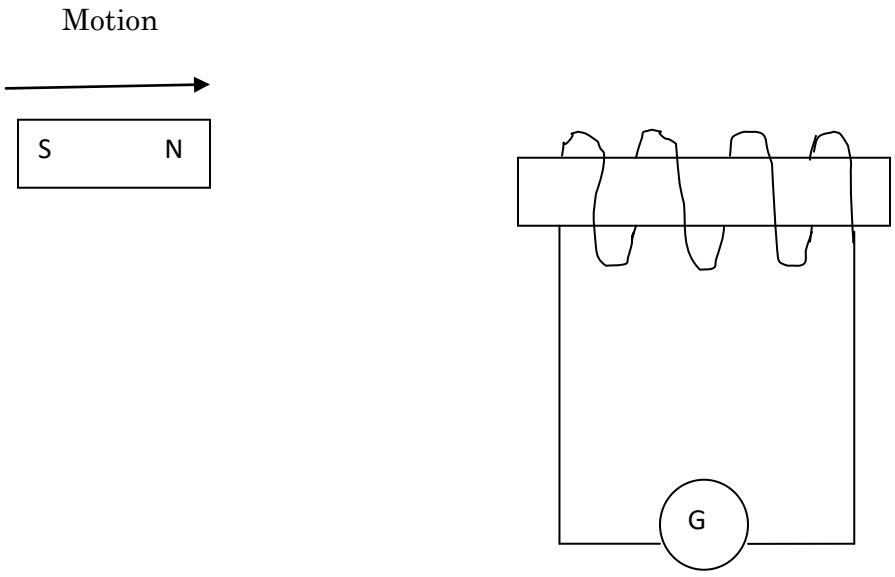
QUESTION FIVE

(i) Draw a diagram of a simple moving coil instrument and explain its operation. (6 marks)

(ii) Show that the emf induced in a coil is given by:

$e = -N\frac{d\phi}{dt}$ Volt (4 marks)

(iii) Determine the direction of the induced current in the circuit of figure 1 (1 mark)



(iv) A conductor 1.2m long is carrying a current of 25A and is placed in a magnetic field of uniform flux density of $0.6wb/m^2$. Calculate the mechanical force of the conductor when the conductor is placed at:

a. Right angles to the magnetic field.
b. 60^0 to the perpendicular to the magnetic field.
c. Horizontal to the magnetic field. (6 marks)

(v) Explain THREE requirements for operation of an analogue instrument.(3 marks)