TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEP 2104 ELECTROMAGNETICSM II

END OF SEMESTER EXAMINATION

SERIES: 2019

TIME: 2 HOURS

DATE: July 2019

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 **Question ONE and ANY other TWO questions.**

$\varepsilon_0 = \frac{1}{36\pi} \times 10^{-9}\ F/m\ ;\ \mu_0 = 4\pi \times 10^{-7}\ H/m$

Do not write on the question paper.

Question ONE

(a) Define mathematically and in words the following magnetic terms indicating units for each.

(i) Magnetic field intensity vector $\bar{H}$ (ii) Magnetic flux density $\bar{B}$

(iii) μ_r (iv) μ_0 (8 marks)

(b) Draw the approximate magnetic field lines for the following current pairs. (2 marks)

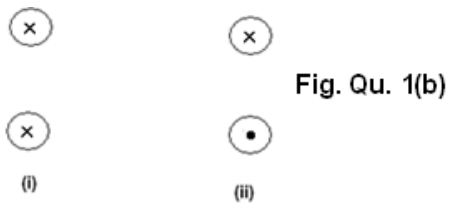


Fig. Qu. 1(b)

(c) (i) A conductor 80cm long is situated at right-angles to a magnetic field. Calculate the flux density of the magnetic field if a current of 10A produces a force on it of 8.6 N. (4 marks)

(ii) Using an appropriate sketch explain the effect of a current carrying conductor when placed in a magnetic field. (6 marks)

Question TWO

(a)` Define mathematically and in words the following magnetic terms indicating units for each.

(i) Magnetic flux ϕ (ii) magnetizing force (6 marks)

(b) Using an appropriate sketch explain the process of creating a B-H curve for a given magnetic material..

(6 marks)

(c) (i) An iron ring of mean diameter 40 cm is uniformly wound with 5000 turns of wire. When a current of

2. 5A is passed through the coil a flux density of 1.8T is set up in the iron. Find (I) the magnetizing force and (II) the relative permeability of the iron under these conditions.

(ii) A mild steel ring has a radius of 20mm and a cross-sectional area of 300mm2. A current of 0.25A flows in a coil wound uniformly around the ring and the flux produced is 1.5mWb. If the relative permeability at this value of current is 300 find (I) the reluctance of the mild steel and (II) the number of turns on the coil. (8 marks)

Question THREE

(a) (i) State Faraday's laws of electromagnetic induction. (ii) State Lenz's law

(iii) Using appropriate sketches describe the two basic mechanisms of power generation. (7 marks)

(b) (i) Distinguish between self and mutual inductance

(ii) A conductor of length 50 cm is moved at 850 mm/s at right-angles to a uniform flux density

of 1.5T. Determine the emf induced in the conductor.

(iii) A 60 cm long conductor moves at a uniform speed of 10 m/s through a uniform magnetic field of flux density 1.3T. Determine the current flowing in the conductor when (I) its ends are open-circuited, (II) its ends are connected to a load of 30 ohms resistance. (9 marks)

(c) A generating coil on a former 350mm long has 300 turns and rotates in a 1.3 T magnetic field. Calculate the maximum emf generated if the coil, having a diameter of 40 mm, rotates at 300 rev/min. (4 marks)

Question FOUR

(a) Explain briefly FOUR factors which affect the inductance of an inductor. (4 marks)

(b) A flux of $400\mu Wb$ passing through a 150 turn coil is reversed in $40ms$. Determine the average emf induced (4 marks)

(c) (i) Calculate the value of the energy stored when a current of 30mA is flowing in a coil of inductance

100mH.

(ii) The energy stored in the magnetic field of an inductor is 100 J when the current flowing in the inductor is 3A. Calculate the inductance of the coil. (4 marks)

(d) In the device shown in Fig. Qu.(4c), when the current in the primary coil of 1000 turns increases linearly from 1A to 4A in 150 ms, an emf of 20V is induced into the secondary coil of 480 turns, which is left open circuited. Determine: (i) the mutual inductance of the two coils, (ii) the reluctance of the former, and (iii) the self-inductance of the primary coil. (8 marks)

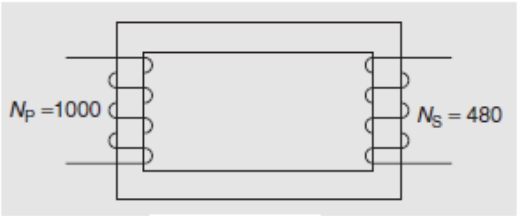
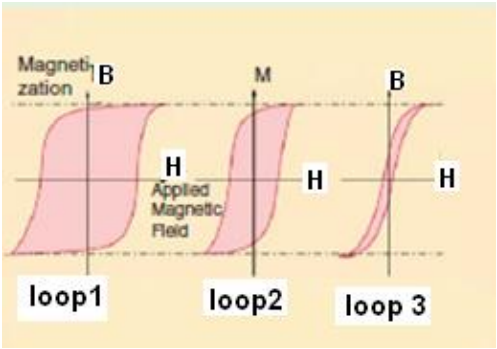


Fig. Qu. (4c)

Question FIVE

(a) Discuss the shape of the following hysteresis loops and the nature of the materials for each. (9 marks)



(b) With reference to Fig. 5 determine the:

(i) Direction of the force on the conductor in Fig. 5(a)

(ii) Direction of the force on the conductor in Fig. 5(b)

(iii) Direction of the current in Fig. 5(c)

(iv) Polarity of the magnetic system in Fig. 5(d). (4 marks)

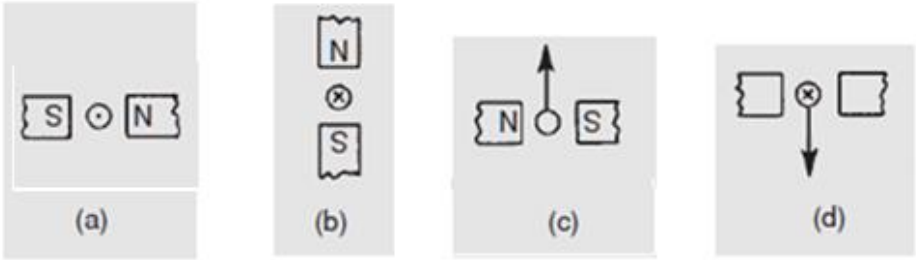


Fig. Qu.5 The reaction of a current carrying conductor in a magnetic field

(c) By means of an appropriate sketch describe the principle of a moving coil instrument. (7 marks)