Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	ELECTROMAGNETISM
COURSE CODE	:	BBV 10102
PROGRAMME CODE	:	BBE
EXAMINATION DATE	:	JULY 2024
DURATION	:	2 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ Closed book 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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Q1 (a) Explain the following terms of electromagnetism in transformer, including symbol, unit, formula, and draw the suitable figure for each term (where necessary):

(i) Power factor
(ii) Full load current
(iii) Half load current
(iv) Voltage regulation
(v) Efficiency

(10 marks)

(b) **Figure Q1.1** illustrates a magnetic circuit. A coil of 500 turns is uniformly wound around a wooden ring with a mean circumference of 500 mm and an area of cross-section of 500 mm^2. If the current flowing into the coil is 2 A, calculate the total flux.

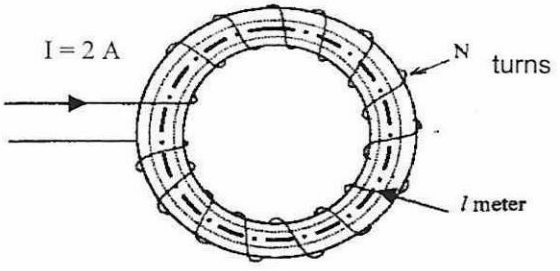

Figure Q1.1

(10 marks)

Q2 A magnetic circuit comprises three parts in series, each of uniform Cross-Section Area (C.S.A). They are :

(i) A length of 80 mm and C.S.A 50 mm^2;
(ii) A length of 60 mm and C.S.A 90 mm^2;
(iii) An airgap of length 0.5 mm and C.S.A 150 mm^2.

A coil of 4000 turns is wound on part (ii), and the flux density in the airgap is 0.3 T. Assuming that all the flux passes through the given circuit, and that the relative permeability μ_r is 1300, estimate the coil current to produce such a flux density.

(20 marks)

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Q3 **Figure Q3.1** illustrates a magnetic circuit made from steel. The central part has a cross-sectional area of 800 mm^2. Each side has a cross-sectional area of 500 mm^2. The characteristics of the steel magnetism are shown in **Table Q3.1**.

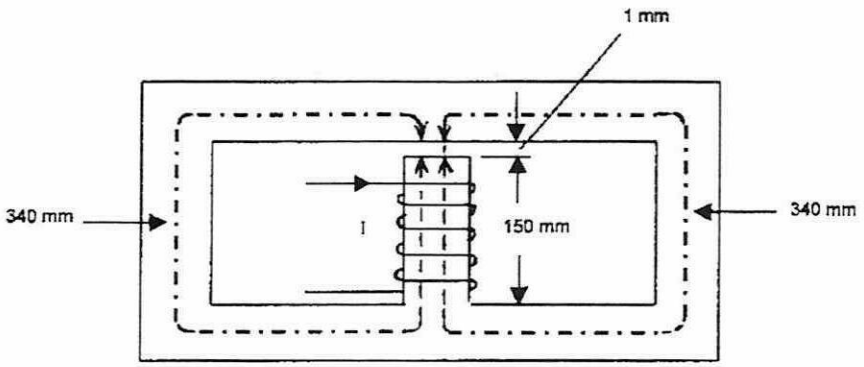

Figure Q3.1

Table Q3.1

Magnetic Flux Density $(Wb/m)^2$	0.9	1.1	1.2	1.3
Magnetic Field Strength (AT/m)	260	450	600	820

If the required flux value in the middle arm is 1 mWb, by neglecting flux leakage and assuming air permeability $(\mu_o) = 4\pi \times 10^{-7}$, determine:

(i) Magnetic field strength on the middle arm.
(ii) Magnetic field strength on side arm.
(iii) Magnetic field strength in the air gap.
(iv) Total of electromagnetic force (m.m.f).

(20 marks)

Q4 A single-phase transformer has 1000 turns on the primary and 200 turns on the secondary. The no-load current is 3 A at a power factor 0.2 lagging the secondary current is 280 A at a power factor of 0.8 lagging. Calculate the primary current and the power factor. Assume the voltage drop in the windings to be negligible.

(20 marks)

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Q5 A 100kVA transformer has 400 turns on the primary and 800 turns on the secondary. The primary and secondary resistances are 0.3W and 0.01W respectively, and the corresponding leakage reactances are 1.1 W and 0.035 W respectively. The supply voltage is 2200 V. Calculate:

(a) The equivalent impedance referred to the primary circuit;

(5 marks)

(b) The voltage regulation and the secondary terminal voltage for a full load having a power factor of the following:

(i) 0.8 lagging, and
(ii) 0.8 leading.

(10 marks)

(c) The percentage resistance and leakage reactance drops of the transformer.

(5 marks)

- END OF QUESTIONS -

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