University College Dublin
An Coláiste Ollscoile, Baile Átha Cliath

MIDTERM EXAMINATIONS - 2018/2019

School of Electrical and Electronic Engineering

EEEN20090 – Electrical Energy Systems

Module Coordinator: Prof. Federico Milano *

Time Allowed: 50 minutes

Instructions for Candidates

Answer all questions from any two of the three sections.
All question papers **must** be handed up with the answer booklets at the end of the exam.
The distribution of marks in the right margin gives an approximate indication of the relative importance of each part of the question.

Instructions for Invigilators

Non-programmable calculators are permitted.

Section A

For the circuit shown in 1 and assuming $\omega = 1000$ rad/s, determine

1. The Thévenin equivalent circuit ($\bar{V}_{\text{th}}$, $\bar{Z}_{\text{th}}$) at the terminals a-b. 50%
2. The current $\bar{I}_{\text{load}}$ in a resistive load connected to the terminals a-b, if the resistance of the load is 1 kΩ. 50%

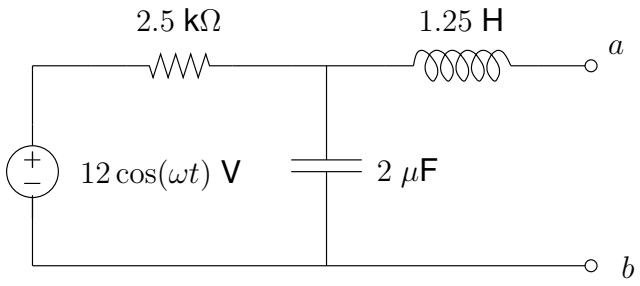


Figure 1

Section B

The current in the 900-turn coil of the magnetic system shown in Figure 2 is 0.2 A. The permeability μ of the iron core is infinite. Determine:

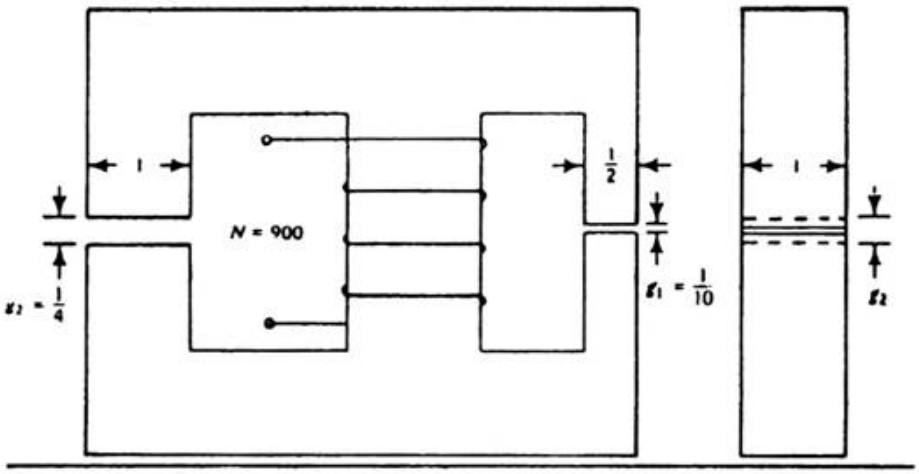
3. The fluxes ϕ_1 and ϕ_2 in the air gaps. 50%
4. The flux ϕ in the central column of the iron core. 20%
5. The self-inductance L of the magnetic circuit. 30%

Section C

A 200 kVA single-phase transformer with a voltage ratio $6350/660$ V has the following winding resitances and reactances:

$$R_1 = 1.56\ \Omega, \quad R_2 = 0.016\ \Omega, \quad X_1 = 4.67\ \Omega, \quad X_2 = 0.048\ \Omega.$$

On no-load, the transformer takes a current of 0.96 A at power factor 0.263 lagging.



Electromagnet with two air gaps in parallel.
Dimensions are in centimeters.

Figure 2

Calculate:

6. The equivalent short-circuit resistance R'_{sc} and reactance X'_{sc} referred to the high-voltage winding. 25%

7. The iron-core equivalent resistance R_{Fe} and magnetizing reactance X_{μ} referred to the high-voltage winding. 25%

8. The voltage regulation $\epsilon_{\%}$ at unity power factor (p.f.), 0.8 lagging p.f. and 0.8 leading p.f. 50%

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