UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	ELECTRICAL MACHINE
COURSE CODE	:	BBV30203
PROGRAMME CODE	:	BBE
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
INSTRUCTION	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) The basic part of DC machine are stator and rotor. Describe:
(i) Stator.

(2 marks)

(ii) Rotor.

(2 marks)

(b) A commutator is important part of DC generator.
(i) Describe the function of commutator in a DC generator.

(2 marks)

(ii) Explain how commutator work in a DC generator by using a suitable diagram.

(4 marks)

(c) A saparately exited DC generator is connected to a 50 Ω load and a current of 8 A flows. If the armature resistance os 0.8 Ω. The exciter voltage is 230 V.

(i) Draw and label the equivalent circiut of this generator.

(2 marks)

(ii) State the equation for the equivalent circuit of the DC generator.

(2 marks)

(iii) Calculate the terminal voltage.

(3 marks)

(iv) Calculate the generated EMF.

(3 marks)

Q2 (a) Draw and label the equivalent circuit of DC motor listed below:

(i) Shunt wound rotor.

(1 marks)

(ii) Series wound motor.

(1 marks)

(iii) Compound wound motor.

(1 marks)

(b) By using a basic construction of separately excited DC motor, explain how the rotor of DC motor rotates and how reversal of rotation can be made.

(8 marks)

(c)   A 240V shunt DC motor takes a total current of 30 A. If the field winding resistance $R_f=150\Omega$ and the armature resistance $R_a=0.3\Omega$. Calculate :

(i) The armature current.

(3 marks)

(ii) Back EMF.

(3 marks)

(iii) Maximum efficiency of the motor .

(3 marks)

Q3   (a)   Define what is AC generator.

(2 marks)

(b)   By using a suitable diagram explain how single phase AC voltage is generated from AC generator.

(4 marks)

(c)   For the large AC three phase generator, it is more practical to rotate the magnetic field and fix armature winding. By using a suitable diagram, explain how the three phase AC voltage is generated by the large three phase generator.

(8 marks)

(d)   A synchronous generator with 6 poles is attached to prime mover. Determine the speed of generator in order to produce a voltage with frequency of:

(i) 50 Hz

(3 marks)

(ii) 60 Hz

(3 marks)

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Q4 (a) List down two (2) types of single phase induction motor.

(3 marks)

(b) Draw the equivalent circuit for two (2) types of single phase induction motor in question Q4 (a).

(4 marks)

(c) Induction motor is a great invention in history of electrical machine evolution. Describe three (3) advantages of induction motor.

(3 marks)

(d) By using a suitable diagram, illustrate how a single phase capacitor start induction motor rotates and how reversal of rotation can be made.

(10 marks)

Q5 (a) A 400 V, 60 Hz and 6 poles three phase induction motor rotate at 1140 rpm when reveived power supply 40 kW at 0.8 lagging power factor. The stator losses is 1 kW. The windage and friction losses is 2 kW. Calculate:

(i) Slip.

(2 marks)

(ii) Rotor copper losses.

(2 marks)

(iii) Mechanical power output.

(3 marks)

(iv) Efficiency of the motor.

(3 marks)

(b) Illustrate the rotation of stator magnetic field by using a basic stator construction of three phase squirrel cage induction motor and three phase supply waveforms.

(10 marks)

- END OF QUESTIONS -

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