Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	ELECTRICAL MACHINE
COURSE CODE	:	BBV 30203
PROGRAMME CODE	:	BBE
EXAMINATION DATE	:	DECEMBER 2018/JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 (a) State the definition of
(i) Motor
(ii) Generator

(4 marks)

(b) A rectangular coil of sides 10 cm and 6 cm is rotated in a magnetic field of flux density 1.2 T, the longer side of the coil actually cutting this flux. The coil is made up of 80 turns and rotates at 1000 rotation/min.
(i) Calculate the maximum generated e.m.f.

(5 marks)

(ii) If the coil generates 80 V, at what speed will the coil rotate?

(5 marks)

(c) In general, there are three types of DC machine equivalent circuits namely permanent magnet, separately excited and self-excited. Draw the equivalent circuit for the following DC machines
(i) Self-excited series machine
(ii) Self-excited shunt machine
(iii) Separately excited

(6 marks)

Q2 (a) A 220V DC shunt motor draws 10 A at 1800 rpm. The armature resistance is 0.2 Ω and field winding resistance is 440 Ω.
(i) Determine the torque

(7 marks)

(ii) Calculate the speed and line current at a torque of 20 Nm (if field current is constant)

(7 marks)

(ii) Compare the speed determined in **Q2**(a)(ii) with the question. What can be conluded regarding the speed of the shunt-wound DC motor?

(2 marks)

(b) Sketch a torque versus speed graph for shunt-wound, series-wound and compounded-wound DC motor connections.

(4 marks)

Q3 (a) For a 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)

(b) The ACB or negative sequence is produced when the generator rotates clockwise. If the reference phasor is A,

(i) plot the three-phase voltages in the phasor domain (start with phase A as the reference). State the phasor domain equations

(5 marks)

(ii) Plot the three-phase voltages in the time domain (start with phase A as the reference). State the time domain equation

(5 marks)

(c) For a 6-pole, 60 Hz generator, what is the speed (in rpm) of the rotor?

(2 marks)

Q4 (a) Induction motor have two main parts namely stator and rotor. Describe the main parts below

(i) Outer frame
(ii) Stator core
(iii) Stator winding

(3 marks)

(b) List down three (3) types of single-phase induction motor

(3 marks)

(c) Induction motor is a great invention in history of electrical machine evolusion. Describe three (3) advantages and three (3) disadvantages of inducton motor.

(6 marks)

(d) By using a suitable diagram, explain the stages of losses for an induction motor.

(5 marks)

(e) There are two types of rotors which are employed in three phase induction motor which are squirrel cage rotor and slip ring rotor.

(i) Sketch the squirrel cage rotor.
(ii) Give two (2) reasons why the rotor slots are not parallel to the shaft.

(3 marks)

Q5 (a) The power supplied to a three-phase induction motor is 40 kW and the stator losses are 1200 W. If the slip is 5%, determine

(i) the rotor copper loss
(ii) the total mechanical power developed by the rotor
(iii) the output power of the motor if friction and windage losses are 750 W
(iv) the efficiency of the motor, neglecting rotor copper loss

(10 marks)

(b) A 400 V, 50 Hz, 6-pole, Delta-connected, three-phase induction motor consumes 75 kW with a line current of 75 A. The motor runs at slip of 2.5%. If stator iron loss is 2 kW and the resistance between two stator terminals is 0.32 Ω. The windage and friction loss is 1.2 kW. Calculate

(i) Power supplied to rotor, P_2
(ii) Rotor Cu Loss, P_{CU}
(iii) Power supplied to load, P_{out}
(iv) Efficiency
(v) Shaft torque developed

(10 marks)

- END OF QUESTIONS -