UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME   : ELECTRICAL MACHINE

COURSE CODE   : BBV 30203

PROGRAMME CODE   : BBE

EXAMINATION DATE   : JUNE / JULY 2018

DURATION   : 3 HOURS

INSTRUCTION   : ANSWER **ALL** QUESTIONS

TERBUKA

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

Q1 (a) Draw and label the equivalent circuit of DC motor listed below
(i)   shunt-wound motor.
(ii)   series-wound motor.
(iii) compound wound motor.

(6 marks)

(b) Draw and explain how reversal of rotation can be made for shunt wound DC motor.

(4 marks)

(c) A 240 V shunt motor takes a total current of 20 A. If the field winding resistance R_f =140 Ω and the armature resistance R_a = 0.2 Ω, determine
(i)   the armature current.
(ii)   back EMF.
(iii) efficiency of the motor.

(10 marks)

Q2 (a) State two (2) advantages and two (2) disadvantages of three phase AC induction motor

(4 marks)

(b) Calculation involving overall motor efficiency must take into account the losses that occur both in the stator and the rotor. Describe the types of losses below.
(i)   Copper loss
(ii)   Iron loss
(iii)   Windage loss
(iv)   Friction loss

(8 marks)

(c) A three phase 40 kW, eight (8)-pole induction motor is connected to 415 V 50 Hz supply. In full-load condition, the efficiency is 85%, 0.8 lagging power factor, and slip at 3 percent (3 %). Determine the
(i)   rotor speed.
(ii)   rotor frequency.
(iii) torque of the shaft.
(iv) phase current and line current if stator is connected in delta connection.

(8 marks)

Q3 (a) Explain the principle of operation for DC generator with the help of a suitable diagram magnets, conductor and commutator from angle 0° to 360°.

(12 marks)

(b) A rectangular coil of sides 12 cm and 8 cm is rotated in a magnetic field of flux density 1.4 T, the longer side of the coil actually cutting this flux. The coil is made up of 80 turns and rotates at 1200 rev/min.
(i) Calculate the maximum generated e.m.f.
(ii) If the coil generates 90 V, at what speed will the coil rotate?

(8 marks)

Q4 (a) List down three (3) 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 have two main parts namely stator and rotor. Describe the main parts below
(i) Outer frame
(ii) Stator core
(iii) Stator winding

(3 marks)

(d) The power supplied to a three-phase induction motor is 40 kW and the stator losses are 1200 W. If the slip is 4%, 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 740 W
(iv) the efficiency of the motor, neglecting rotor copper loss

(10 marks)

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Q5 (a) Define what is a generator and a motor.

(4 marks)

(b) 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)

(c) A synchronous generator with four (4) poles is attached to prime mover. Determine the speed of generator in order to produce a voltage with frequency of
    (i)   50 Hz.
    (ii)   60 Hz.

(4 marks)

(d) For a 4 pole, 60 Hz generator, what is the speed in RPM of the rotor?

(2 marks)

(e) What would be the frequency of a 6 pole machine spinning at the same RPM in question Q5(d)?

(2 marks)

- END OF QUESTIONS -