UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 2
SESSION 2015/2016

COURSE NAME   :   ELECTRICAL MACHINE

COURSE CODE   :   BBV 30203

PROGRAMME   :   BBE

EXAMINATION DATE   :   JUNE / JULY 2016

DURATION   :   3 HOURS

INSTRUCTION   :   ANSWER **ALL** QUESTIONS

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

S1 (a) The basic parts of DC machine are stator and rotor. List down the components of:

    (i)   Rotor.
    (ii)   Stator.

(4 marks)

    (b) A commutator is important part of DC generator.

    (i)   Describe the function of commutator in a DC generator.
    (ii)   Explain how commutator work in a DC generator by using a suitable diagram.

(6 marks)

    (c) A DC shunt generator supplies a 18 kW load at 220 V through cable of resistance, R=110 mΩ. If the field winding resistance R_f=60 Ω and the armature resistance, R_a = 50 mΩ, determine:

    (i)   The terminal voltage.
    (ii)   Generated EMF in the armature.

(10 marks)

S2 (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) Explain how reversal of rotation can be made for shunt wound DC motor.

(4 marks)

    (c) A 240V shunt motor takes a total current of 30A. If the field winding resistance R_f =150Ω and the armature resistance R_a =0.3 Ω. Determine :
    (i)   The armature current.
    (ii)   Back EMF.
    (iii) Maximum efficiency of the motor.

(10 marks)

S3 (a) Describe types of losses below:

      (i)   Copper loss.
      (ii)   Iron loss.
      (iii) Windage loss.
      (iv) Friction loss.

                                         (8 marks)

(b) A separately excited DC generator is connected to a 50Ω load and a current of 8 A flows. If the armature resistance is 0.8Ω. The excitor voltage is 240V.

      (i)   Draw and label the equivalent circuit of this generator.
      (ii)   State the equation for the equivalent circuit of the DC generator.
      (iii) Calculate the terminal voltage.
      (iv) Calculate the generated EMF.

                                       (12 marks)

S4 (a) Define what is a 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.
      ii)   60 Hz.

                                         (6 marks)

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S5 (a) Describe what is the meaning of slip in three (3) phase induction motor.

(2 marks)

(b) Draw the rotation of stator magnetic field in squirrel cage three phase motor according to the three phase supply waveform.

(8 marks)

(c) The power supplied to a three-phase induction motor is 45 kW and the stator losses are 1200 W. If the slip is 5 per cent, 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 650 W.
(iv) the efficiency of the motor.

(10 marks)

END OF QUESTIONS

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