CBCS SCHEME

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15EE44

Fourth Semester B.E. Degree Examination, June/July 2019
Electric Motors

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What do you mean by back emf in dc motors? Explain the significance of back emf. Also derive the condition for maximum power in dc motors. **(10 Marks)**

b. A 230 V series motor is taking 50 A. Resistance of armature and series field winding is 0.2 Ω and 0.1 Ω respectively. Calculate:
i) Brush voltage
ii) Back emf
iii) Power wasted in armature and mechanical power developed **(06 Marks)**

OR

2 a. Define torque. Derive the expression for torque developed by DC motor from fundamentals. **(10 Marks)**

b. A DC motor drives a 100 KW generator having an efficiency of 87%.
i) What should be the KW rating of the motor?
ii) If the overall efficiency of the motor generator set is 74%, what is the efficiency of the motor?
iii) Also calculate the losses in each machine. **(06 Marks)**

Module-2

3 a. With a neat circuit diagram, explain how Hopkinson's test is performed on dc shunt machines. Mention the merits and demerits of this test. **(10 Marks)**

b. The Hopkinson test on two shunt machines gave the following results for full load.
Line voltage 250 V
Line current excluding field currents 50A
Motor armature current 380A
Field currents 5A and 4.2A.
Calculate the efficiency of each machine. Armature resistance of each machine is 0.02 Ω **(06 Marks)**

OR

4 a. Describe Swinburne's test with the help of neat diagram to find out the efficiency of a dc machine. What are the main advantages and disadvantages of this test? **(10 Marks)**

b. A 220V dc shunt motor at no load takes a current of 3A. The resistance of the armature and shunt field are 0.9 Ω and 250 Ω respectively. Estimate the efficiency of the motor when input current is 18 a. **(06 Marks)**

Module-3

5 a. Draw the phasor diagram of 3ϕ induction motor on no load and load condition and explain. **(06 Marks)**

b. The following test results refer to a 3ϕ 20HP 440V delta connected, 50Hz 4 pole induction motor.
Running light tests : 440V, 10A (line) 1.5 KW input
Locked rotor test: 120V, 30A (line) 2.25 KW input
Draw the circle diagram of this induction motor and determine from the circle diagram full load current and power factor. **(10 Marks)**

OR

6 a. Develop the equivalent circuit of a double cage induction motor and obtain the approximate equivalent circuit. **(06 Marks)**

b. The standstill impedance of the outer cage of a double cage induction motor is $(0.3 + j0.4)\Omega$ and that of the inner cage is $(0.1 + j1.5)\Omega$. Compare the relative currents of the two cages (i) at standstill (ii) at a slip of 5%. Neglect stator impedance. **(10 Marks)**

Module-4

7 a. With a neat diagram, explain star delta starter used for starting 3ϕ induction motor. **(06 Marks)**

b. Explain briefly the different methods of speed control of 3ϕ induction motor. **(10 Marks)**

OR

8 a. Explain double revolving field theory with reference to single phase induction motor. **(06 Marks)**

b. Explain the construction and working of shaded pole motor. **(10 Marks)**

Module-5

9 a. With a neat diagram explain the principle of operation of a 3ϕ synchronous motor. **(06 Marks)**

b. Explain the operation of a synchronous motor under (i) constant load, varying excitation (ii) constant excitation, varying load. Discuss how a synchronous motor can function as synchronous condenser. **(10 Marks)**

OR

10 a. What is a two phase servo motor? Describe its construction and working. Draw its torque speed characteristics for various control voltages. **(10 Marks)**

b. Explain the principle of operations of a linear induction motor. Draw its characteristics. State its important applications. **(06 Marks)**

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