CBCS SCHEME

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17EE44

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022
Electric Motors

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is back emf? Explain its significance. **(06 Marks)**

b. Derive expression for the torque of a DC motor. **(06 Marks)**

c. A 250V DC motor has a $R_a = 0.08\Omega$. When connected to 250V DC supply it develops a back emf of 242V at 1500rpm. Determine:
i) Armature current
ii) Armature current at start
iii) Back emf if armature current is changed to 120A
iv) The speed of the machine if it is operated as a generator in order to deliver an armature current of 87A at 250V. **(08 Marks)**

OR

2 a. Explain the different methods of controlling speed of a DC shunt motor. **(06 Marks)**

b. Explain the necessity of starter for a DC motor and explain the operation of a 3 point starter with a neat sketch. **(08 Marks)**

c. Draw and explain the characteristics of a DC series motor. **(06 Marks)**

Module-2

3 a. Enumerate the various losses in a DC machine, which of these losses are constant, Proportional to current and Proportional to current square? **(06 Marks)**

b. With a neat circuit diagram, explain the importance and procedure of conducting Swinburne test on DC motor. List the advantages of this test. **(08 Marks)**

c. Describe the Hopkinson's test for 2 identical shunt motors indicating how the efficiency of each machine on full load is obtained. **(06 Marks)**

OR

4 a. Derive torque equation for a 3ϕ induction motor and derive condition for maximum torque. **(08 Marks)**

b. Discuss the complete torque-ship characteristics of a 3ϕ induction motor including motoring, generating and braking regions. **(08 Marks)**

c. A 4 pole, 3 ϕ induction motor is supplied from 50Hz supply. Determine its synchronous speed. On full load, its speed is observed to be 1410rpm. Calculate its full load slip. **(04 Marks)**

Module-3

5 a. Starting from the fundamentals develop the equivalent circuit of a polyphase induction motor and explain how mechanical power developed is taken care in the equivalent circuit. **(10 Marks)**

b. Describe the constructional features of a double cage and deep bar rotors of induction motor and explain its operation. **(10 Marks)**

OR

6 a. Draw the circle diagram for a 20HP, 50Hz, 3ϕ phase, star connected induction motor with the following data:

No load test:	400V	9A	0.2pf lagging
Blocked rotor test:	200V	50A	0.4pf lagging

Determine the current, efficiency and slip for full load condition from the circle diagram. **(14 Marks)**

b. Explain the phenomenon of cogging and crawling in a 3ϕ Induction Motor. **(06 Marks)**

Module-4

7 a. Name the different methods of starting a squirrel cage Induction Motor. Explain Y-Δ starter of 3-ph induction motor with a suitable diagram. **(10 Marks)**

b. Describe the different speed control methods of a 3ϕ Induction Motor. **(10 Marks)**

OR

8 a. Explain double field revolving theory as applied to a single phase Induction Motor and prove that it cannot produce any starting torque. **(10 Marks)**

b. With a schematic connection diagram, explain the construction, working and applications of capacitor start Induction Motor. **(10 Marks)**

Module-5

9 a. State the methods of starting synchronous motor. Explain any one in detail. **(06 Marks)**

b. Why synchronous motors are not self starting? Explain with a neat sketch. **(06 Marks)**

c. Explain the effect of variable load with constant excitation on synchronous motor. **(08 Marks)**

OR

10 a. Explain the operation of synchronous motor at constant load variable excitation. **(06 Marks)**

b. Explain V and Inverted V curves of synchronous motor. **(06 Marks)**

c. Explain the working, characteristics and applications of universal motor. **(08 Marks)**

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