CBCS SCHEME

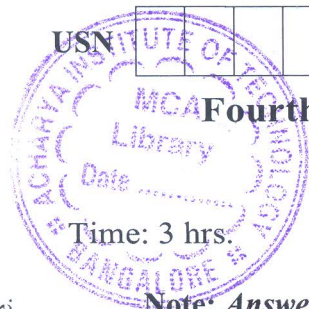USN ⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚

Fourth Semester B.E. Degree Examination, June/July 2023
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. Explain the principles of torque production in DC motor and derive the torque equation of a DC motor and explain various types of torque in DC motor. **(10 Marks)**
    b. Briefly explain the various losses that occur in DC machine. Draw the power flow diagram of a DC motor and derive the condition for maximum efficiency. **(10 Marks)**

OR

2   a. What is the necessity of starter? Explain with a neat diagram, the operation of 3 point starter. **(10 Marks)**
    b. A 230V DC shunt motor runs at 800 rpm and takes armature current of 50A. Find the resistance to be added to the field circuit to increase the speed from 800 rpm to 1000 rpm at an armature current of 80A. Assume flux is proportional to field current , Armature resistance is 0.15Ω and field resistance is 250Ω. **(10 Marks)**

Module-2

3   a. With neat circuit diagram, explain Swinburne's test on DC motor. Show how the η of motor can be predetermined. Mention the merits and demerits of this test. **(10 Marks)**
    b. Hopkinson's test is conducted on two DC shunt machines. The supply current is 15A at 200V. The generator O/P current is 85A. The field current of motor and generator are 2.5A and 3A respectively. The armature resistance of each machine is 0.05Ω. Find the efficiency of each machine on load. **(10 Marks)**

OR

4   a. Discuss the torque – slip characteristics of 3ϕ induction motor including motoring , generating and breaking regions. **(10 Marks)**
    b. A 400V, 4 pole , 3 phase , 150 Hz star connected induction motor has rotor resistance and reactance per phase equal to 0.01Ω and 0.1Ω respectively. Determine i) Starting torque ii) Slip at which maximum torque will occur   iii) Speed at which maximum torque will occur   iv) Maximum torque   v) Full load torque if full load slip is 4%. Assume ratio of stator to rotor turns as 4. **(10 Marks)**

Module-3

5   a. Explain No load test and Blocked rotor test in a 3 phase induction motor. How are the parameters of equivalent circuit determined from test results? **(10 Marks)**
    b. A 25KW, 4 pole 3ϕ , 50Hz induction motor is running at 1410 rpm, supplying full load. The mechanical losses are 850W and stator losses are 1.7 times rotor copper losses on full load. Calculate i) Gross mechanical power developed   ii) Rotor copper losses iii) The value of rotor resistance / phase if rotor current on full load / phase is 65A. iv) Full load efficiency. **(10 Marks)**

OR

6 a. Explain with a neat circuit diagram, the construction and operation of a double cage induction motor. Draw the equivalent circuit and speed torque characteristics. **(10 Marks)**

   b. The power input to the rotor of a 440V, 50Hz, 3 phase , 6 pole induction motor is 60KW. It is observed that rotor emf makes 90 complete cycle / minute. Calculate
   i) Slip   ii) Rotor copper loss   iii) Mechanical power developed. **(10 Marks)**

Module-4

7 a. Mention the different methods of speed control of 3 phase induction motor. Describe any two methods. **(10 Marks)**

   b. Justify the necessity of starter for 3 phase induction motor and hence explain Star – delta starter. **(10 Marks)**

OR

8 a. Why single phase induction motor is not self starting? Explain the principle of operation of single phase induction motor using double revolving field theory. **(10 Marks)**

   b. Explain the Construction and Operation of :
   i) Capacitor start single phase induction motor.
   ii) Capacitor start, capacitor run single phase induction motor. **(10 Marks)**

Module-5

9 a. Explain the operation of synchronous motor at constant load and variable excitation with phasor diagram. **(10 Marks)**

   b. Briefly explain V and inverted V curves of synchronous motor. **(10 Marks)**

OR

10 a. Explain the construction , working , characteristics and application of AC servomotor. **(10 Marks)**

   b. Explain the principle of operation of linear induction motor and draw its characteristics. List some applications of it. **(10 Marks)**

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