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Fourth Semester B.E. Degree Examination, June/July 2025
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. Define torque. Derive the torque equation of a DC motor. (06 Marks)
 - b. Explain electrical and mechanical characteristics of DC shunt motor. (08 Marks)
 - c. A dc series motor is running with a speed of 800 rpm. While taking a current of 20 A from the supply. If the load is changed such that the current drawn by the motor is increased to 50 A. Calculate the speed of the motor on new load. The armature and series field winding resistances are 0.2Ω and 0.3Ω respectively. Assume the flux produced is proportional to the current. Assume supply voltage as 250 V. (06 Marks)

OR

- 2
 - a. Explain the different types of DC motor and its applications. (06 Marks)
 - b. With a neat sketch, explain 3 point starter. (06 Marks)
 - c. A 6 pole, 500 V, wave connected shunt motor has 1200 armature conductors and useful flux/pole is 20 mwb. Armature and field resistance are 0.5Ω and 250Ω . What will be the speed and torque developed by the motor when it draws 20 Amps from the supply? Neglect armature reaction. If magnetic and mechanical losses are 900 watts. Find:
 - i) useful torque
 - ii) Efficiency at this load. (08 Marks)

Module-2

- 3
 - a. With a neat circuit diagram, explain the efficiency of motor and generator can be predetermined by using Swinburne method. (08 Marks)
 - b. The Hopkinson's test on two dc shunt machines gave the following results on full load. Line voltage = 220 Volts, line current excluding field currents = 15 Amps, motor armature current is 72 Amps. The field currents are 1.5 Amps and 1.0 Amp for generator and motor respectively. The armature resistance of each machine is 0.2Ω , calculate the efficiency of the machine. (08 Marks)
 - c. Explain the significance of slip in an induction motor. (04 Marks)

OR

- 4
 - a. Explain the retardation test on dc machines. (06 Marks)
 - b. With a neat vector diagram, explain the concept of rotating magnetic field of 3- ϕ induction motor. (08 Marks)
 - c. A 3 phase, 400 V, 50 hz, 4 pole induction motor has star connected stator winding the rotor resistance and reactance are 0.1Ω and 1Ω respectively. The full load speed is 1440 rpm. Calculate the torque developed on full load by the motor. Assume stator to rotor ratio as 2:1. (06 Marks)

Module-3

- 5 a. Develop an equivalent circuit model of an induction motor referred to stator. (05 Marks)
 b. Explain how induction motor working as induction generator. (05 Marks)
 c. Draw the circle diagram from no-load and short circuit test of a 3-phase, 14.92 KW, 400 V, 6 pole induction motor with the following test data (line values)
 No load : 400 V, 11 A, 0.2 pf
 Short circuit test : 100 V, 25 A, 0.4 pf
 Rotor copper loss at stand still is half the total copper loss. From the diagram, find :
 i) Line current
 ii) Efficiency
 iii) Slip
 iv) PF at full load
 v) Maximum torque (10 Marks)

OR

- 6 a. Explain the concept of cogging and crawling of 3-phase induction motor. (10 Marks)
 b. Describe the construction of a double cage induction motor. Explain its working and draw the equivalent circuit. (10 Marks)

Module-4

- 7 a. Why starter is necessary for 3 phase induction motor? Explain with neat diagram, the operation of DOL starter. (06 Marks)
 b. Explain with neat diagram, the working principle of capacitor start single phase induction motor. (06 Marks)
 c. Explain the construction and working of shaded pole induction motor. (08 Marks)

OR

- 8 a. With a neat diagram, explain star delta and autotransformer starter. (08 Marks)
 b. Explain voltage and frequency method of speed control in 3 phase induction motor. (06 Marks)
 c. Explain double revolving field theory in induction motor. (06 Marks)

Module-5

- 9 a. Explain V and inverter V curves of synchronous motors. (06 Marks)
 b. State the different methods of starting synchronous motor. Explain any one method in detail. (08 Marks)
 c. Write a note on AC servomotor. (06 Marks)

OR

- 10 a. Explain hunting and damping in synchronous motor. (06 Marks)
 b. Explain the construction and operation of universal motor. (08 Marks)
 c. Discuss briefly about stepper motor. (06 Marks)

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