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18EE44

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? Derive the armature torque equation of a DC motor. (08 Marks)
- b. A DC shunt motor takes an armature current of 110A at 480V. The armature circuit resistance is 0.2Ω . The motor has 6 – poles and the armature is lap – connected with 864 conductors. The flux per pole is 0.05 wb. Calculate : i) Speed ii) the gross torque developed by the armature. (08 Marks)
- c. List out the applications of DC motors. (04 Marks)

OR

- 2 a. What is the necessity of starter? Explain the operation of a 3-point starter. (08 Marks)
- b. A 4 pole, 220V shunt motor has 540 lap-wound conductor. It takes 32A from the supply mains and develops output power of 5.6KW. The field winding takes 1A. The armature resistance is 0.09Ω and the flux per pole is 30mwb. Calculate : i) the speed ii) the torque developed. (08 Marks)
- c. Explain the speed control of a DC shunt motor by field control method. (04 Marks)

Module-2

- 3 a. Explain with a neat diagram, field test of two DC series machines to determine the efficiency. (10 Marks)
- b. Derive the torque equation of a 3- ϕ induction motor and obtain the condition for max running torque. (10 Marks)

OR

- 4 a. Explain back to back test on two identical DC shunt machines and calculate the efficiency of machines as generator and motor. (10 Marks)
- b. Discuss the torque – slip characteristics of a three phase induction motor including motoring, generating and braking regions. (10 Marks)

Module-3

- 5 a. Explain no-load and blocked rotor test on 3-phase induction motor. How are the parameters of equivalent circuit determined from above tests? (12 Marks)
- b. The power input to the rotor of a 400V, 50Hz, 6-pole, 3-phase induction motor is 20KW. The slip is 3%. Calculate : i) the frequency of rotor current ii) the rotor speed iii) rotor copper losses iv) rotor resistance per phase of rotor current is 60A. (08 Marks)

OR

- 6 a. With a neat sketches, explain the working of high torque rotors of induction motor. (12 Marks)
- b. The power input to a 500V, 50Hz, 6-pole three phase induction motor running at 975rpm is 40KW. The stator losses are 1KW and friction and Windage losses are 2KW. Calculate : i) slip ii) rotor copper losses iii) shaft power iv) efficiencies. (08 Marks)

Module-4

- 7 a. Name the different methods of a starting of squirrel case induction motor. Explain the rotor resistance starter of 3-phase induction motor. (10 Marks)
- b. Describe any two methods of speed control of a 3-phase induction motor. (10 Marks)

OR

- 8 a. Explain the principle of operation of single phase induction motor using double revolving field theory. (10 Marks)
- b. Explain the construction and working principle of shaded pole induction motor. (10 Marks)

Module-5

- 9 a. Explain the V and inverted V-curves of an synchronous motor. (10 Marks)
- b. Explain the operation of synchronous motor at constant excitation with variable load. (10 Marks)

OR

- 10 a. Explain the construction and working principle of linear induction motor. (10 Marks)
- b. Explain the construction and working principle of a universal motor. (10 Marks)
