



# CBCS SCHEME

15EE44

## Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020 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. Explain the principles of torque production in dc motor and derive the torque equation of a dc motor. (06 Marks)
- b. With the help of relevant characteristic, explain why a series motor should never be started at no load. (05 Marks)
- c. A shunt wound motor has a armature resistance of  $0.1\Omega$ . It is connected across 220V supply. The armature current taken by the motor is 20A and the motor runs at 800rpm. Calculate additional resistance to be inserted in series with the armature to reduce speed to 520rpm. Assume that there is no change in armature current. (05 Marks)

**OR**

- 2 a. With a neat sketch, explain the Ward-Leonard method of speed control of DC motor. (06 Marks)
- b. Explain the different types of losses in a DC motor. (04 Marks)
- c. A 250V, 15kW DC shunt motor has a maximum efficiency of 88% and a speed of 700rpm, when delivering 80% of its rated output. The resistance of its shunt field is  $100\Omega$ . Determine the armature resistance. (06 Marks)

### Module-2

- 3 a. A 400V, DC shunt motor when running on no load takes 5A. Armature resistance (including brushes) is  $0.5\Omega$  and shunt field resistance is  $200\Omega$ . Find the output in KW and efficiency of the motor when running on full load and taking a current of 50A. (05 Marks)
- b. Explain back to back test on two identical DC machines and calculate the efficiency of the machines as a generator and motor. (07 Marks)
- c. Explain the advantages and disadvantages of field's test applied to two similar DC series motors. (04 Marks)

**OR**

- 4 a. Derive an expression for rotor copper losses in terms of slip and rotor input. (05 Marks)
- b. The power input to the rotor of 440V, 50Hz 6 pole 3 phase induction motor is 80kW. The rotor emf is observed to make 100 complete alternations per minute. Calculate: i) the slip ii) the rotor speed iii) the mechanical power developed. (05 Marks)
- c. Draw and explain the torque characteristics for 3 phase induction motor covering motoring, generating and braking regions of operation. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg,  $42+8=50$ , will be treated as malpractice.

**Module-3**

- 5 a. Draw and explain the phasor diagram of induction motor at slip  $S$ . (06 Marks)  
 b. A 50kW, 6 pole, 50Hz, 450V, 3 $\phi$  slip ring induction motor gave the following test data (line values).  
 No load test : 450V, 20A, p.f. = 0.15  
 Blocked rotor test : 200V, 150A, p.f. = 0.3  
 The ratio of stator to rotor copper losses on short circuit was 5:4. Draw the circle diagram and determine:  
 i) Line current  
 ii) Power factor  
 iii) Slip at full load  
 iv) Efficiency at full load. (10 Marks)

OR

- 6 a. With a neat sketch explain the working of a deep bar cage rotor induction motor. (05 Marks)  
 b. Draw and explain equivalent circuit and torque slip characteristic of a double cage induction motor. (06 Marks)  
 c. Explain the stand alone operation of the induction generator. (05 Marks)

**Module-4**

- 7 a. Why starter is necessary for an induction motor? With a neat diagram, explain the operation of a direct on line starter. (08 Marks)  
 b. Explain any two speed control methods of three phase induction motor. (08 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. (08 Marks)  
 b. With a neat diagram, explain the construction and working principle of split phase induction motor. (08 Marks)

**Module-5**

- 9 a. Briefly explain V and inverted v curves of synchronous motor. (06 Marks)  
 b. Explain how synchronous motor acts as a synchronous condenser. (05 Marks)  
 c. Explain hunting in a synchronous motor. (05 Marks)

OR

- 10 a. Explain the construction working, characteristics and application of ac servomotor. (08 Marks)  
 b. Explain the principle of operation of a linear induction motor. Draw its characteristics. State its important applications. (08 Marks)

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