



# CBCS SCHEME

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15EE44

## Fourth Semester B.E. Degree Examination, June/July 2019 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. What do you mean by back emf in dc motors? Explain the significance of back emf. Also derive the condition for maximum power in dc motors. (10 Marks)
- b. A 230 V series motor is taking 50 A. Resistance of armature and series field winding is  $0.2 \Omega$  and  $0.1 \Omega$  respectively. Calculate:
- Brush voltage
  - Back emf
  - Power wasted in armature and mechanical power developed (06 Marks)

OR

- 2 a. Define torque. Derive the expression for torque developed by DC motor from fundamentals. (10 Marks)
- b. A DC motor drives a 100 KW generator having an efficiency of 87%.
- What should be the KW rating of the motor?
  - If the overall efficiency of the motor generator set is 74%, what is the efficiency of the motor? (06 Marks)
  - Also calculate the losses in each machine.

### Module-2

- 3 a. With a neat circuit diagram, explain how Hopkinson's test is performed on dc shunt machines. Mention the merits and demerits of this test. (10 Marks)
- b. The Hopkinson test on two shunt machines gave the following results for full load.
- Line voltage 250 V  
Line current excluding field currents 50A  
Motor armature current 380A  
Field currents 5A and 4.2A.
- Calculate the efficiency of each machine. Armature resistance of each machine is  $0.02 \Omega$  (06 Marks)

OR

- 4 a. Describe Swinburne's test with the help of neat diagram to find out the efficiency of a dc machine. What are the main advantages and disadvantages of this test? (10 Marks)
- b. A 220V dc shunt motor at no load takes a current of 3A. The resistance of the armature and shunt field are  $0.9 \Omega$  and  $250 \Omega$  respectively. Estimate the efficiency of the motor when input current is 18 a. (06 Marks)

### Module-3

- 5 a. Draw the phasor diagram of  $3\phi$  induction motor on no load and load condition and explain. (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.

- b. The following test results refer to a 3 $\phi$  20HP 440V delta connected, 50Hz 4 pole induction motor.

Running light tests : 440V, 10A (line) 1.5 KW input

Locked rotor test: 120V, 30A (line) 2.25 KW input

Draw the circle diagram of this induction motor and determine from the circle diagram full load current and power factor. (10 Marks)

OR

- 6 a. Develop the equivalent circuit of a double cage induction motor and obtain the approximate equivalent circuit. (06 Marks)
- b. The standstill impedance of the outer cage of a double cage induction motor is  $(0.3 + j0.4)\Omega$  and that of the inner cage is  $(0.1 + j1.5)\Omega$ . Compare the relative currents of the two cages (i) at standstill (ii) at a slip of 5%. Neglect stator impedance. (10 Marks)

Module-4

- 7 a. With a neat diagram, explain star delta starter used for starting 3 $\phi$  induction motor. (06 Marks)
- b. Explain briefly the different methods of speed control of 3 $\phi$  induction motor. (10 Marks)

OR

- 8 a. Explain double revolving field theory with reference to single phase induction motor. (06 Marks)
- b. Explain the construction and working of shaded pole motor. (10 Marks)

Module-5

- 9 a. With a neat diagram explain the principle of operation of a 3 $\phi$  synchronous motor. (06 Marks)
- b. Explain the operation of a synchronous motor under (i) constant load, varying excitation (ii) constant excitation, varying load. Discuss how a synchronous motor can function as synchronous condenser. (10 Marks)

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OR

- 10 a. What is a two phase servo motor? Describe its construction and working. Draw its torque speed characteristics for various control voltages. (10 Marks)
- b. Explain the principle of operations of a linear induction motor. Draw its characteristics. State its important applications. (06 Marks)

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