CBCS SCHEME

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17EE44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Derive the torque equation of a DC motor. **(05 Marks)**

b. What are the limitation of speed control of a dc shunt motor by armature control method? Name and explain the method of overcoming these limitations. **(08 Marks)**

c. A 200V shunt motor has armature resistance of 0.1Ω and shunt field resistance of 240Ω. Its rotational losses are 236W. On full load the line current is 9.8A with the motor running at 1450rpm. Determine
   i) Mechanical power developed
   ii) Power output
   iii) Load torque
   iv) Full load efficiency. **(07 Marks)**

OR

2 a. What is Back emf? Explain its significance in DC motor operation. **(04 Marks)**

b. What is the necessity of starter? Explain with a neat diagram, the operation of a 3-point starter. **(10 Marks)**

c. A 230V, DC shunt motor runs at 800rpm and takes armature current of 50A.Find the resistance to be added to the field circuit to increase speed from 800rpm to 1000rpm at an armature current of 80A. Assume flux is proportional to field current, Armature resistance is 0.15Ω and field resistance is 250Ω. **(06 Marks)**

Module-2

3 a. Explain with a neat diagram, field test of two DC series motors to determine the efficiency of the machines. **(06 Marks)**

b. Hopkinson's test is conducted on two DC shunt machines. The supply current is 15A at 200V. The generator output current is 85A. The field current of motor and generator are2.5A and 3A respectively. The armature resistance of each machine is 0.05Ω. Find the efficiency of each machine on load. **(08 Marks)**

c. Derive torque equation of a 3ϕ induction motor and hence obtain the condition for maximum running torque. **(06 Marks)**

OR

4 a. With a net diagram, explain retardation test by elimination method to determine the stray losses and its separation into core losses and rotational losses. **(08 Marks)**

b. The field test on two mechanically coupled DC series motors with their fields connected in series and one machine running as motor while the other running as generator gave the following data :
   Motor : armature current 40A, armature voltage 200V, voltage drop across fields 15V
   Generator : Armature current 32A, armature voltage 160V, voltage drop across field 15V
   Armature resistance is 0.4Ω, calculate the efficiency of each machine. **(06 Marks)**

c. Develop torque slip characteristics of a 3ϕ induction motor when slip varies between zero and 2. **(06 Marks)**

Module-3

5 a. Develop the phasor diagram of a 3ϕ induction motor on load. **(06 Marks)**

b. List out the disadvantages of squirrel cage Induction motor. Explain with a neat diagram, the construction and operation of a double case induction motor. **(10 Marks)**

c. Show that the locus of rotor current is a semicircle through appropriate equations. **(04 Marks)**

OR

6 a. A 415V, 29.84kW, 50Hz delta connected motor gave following test data :

No load : 415V, 21A, 1250W

Blocked rotor test : 100V, 45A, 2730W

Construct the circle diagram and hence determine :

i) Line current and power factor at full load

ii) Maximum torque

Assume stator and rotor copper losses are equal at standstill. **(12 Marks)**

b. Obtain the phasor diagram and hence the locus of stator current of an Induction generator. **(04 Marks)**

c. List out the merits of Induction Generator. **(04 Marks)**

Module-4

7 a. Justify the need for a starter to start a 3ϕ induction motor. Explain with a neat diagram, the operation of a star delta starter. **(12 Marks)**

b. Explain the construction and operation of shaded pole single phase induction motor. List out its applications. **(08 Marks)**

OR

8 a. What are the limitations of speed control by stator voltage control? **(02 Marks)**

b. Explain why single phase induction motors are not self starting using double field revolving theory. **(08 Marks)**

c. Explain the construction and operation of capacitor start and run 1ϕ Induction motor. **(10 Marks)**

Module-5

9 a. Explain the principle of operation of synchronous motor. **(08 Marks)**

b. Explain with a neat diagram, the construction and operation of linear induction motor and state its application. **(12 Marks)**

OR

10 a. Explain how a synchronous motor can be operated as a synchronous condenser with change in excitation. **(08 Marks)**

b. With a neat diagram, explain the construction and operation of stepper motor. **(12 Marks)**

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