CBCS Scheme

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15EE44

Fourth Semester B.E. Degree Examination, June/July 2017
Electric Motors

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Derive the torque equation of a D.C. motor. **(05 Marks)**

b. What are the applications of D.C. shunt motor, series motor and compound motor? **(05 Marks)**

c. A 4 pole D.C. shunt takes 22 amp from 220 V supply. The armature and shunt field resistances are 0.5Ω and 100Ω respectively. The armature is lap connected with 300 conductors if the flux/pole is 20 milli ωb, calculate the speed and the developed torque. **(06 Marks)**

OR

2 a. With a neat sketch, explain the Ward-Leonard method of speed control of D.C. motor. **(05 Marks)**

b. Explain the operation of a three point starter with a neat sketch. **(05 Marks)**

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

Module-2

3 a. With a neat circuit diagram, explain the importance and procedure of conducting Swinburne test on d.c. motor. Show how the efficiency as motor can be predetermined. **(05 Marks)**

b. Explain back to back test as two identical D.C. machines and calculate the efficiency of the machines as a generator and motor. **(05 Marks)**

c. A test on two coupled tram way motors, with their fields connected in series gave the following results when one machine acted as a motor and the other as a generator.
Motor: Armature current = 56 A, Armature voltage = 590 V, Voltage drop across field winding = 40 V.
Generator: Armature current = 44 A, armature voltage = 400 V, field voltage drop = 40 V, resistance of each armature = 0.3 Ω.
Calculate the efficiency of the motor and generator at this load. **(06 Marks)**

OR

4 a. Derive the torque equation for a three phase induction motor. **(05 Marks)**

b. Discuss the complete torque-slip characteristics of a three phase induction motor including motoring, generating and braking regions. **(05 Marks)**

c. A 400 V, 4 pole 3 phase, 50 Hz star connected induction motor has a rotor resistance and reactance perphase equal to 0.01Ω and 0.1Ω respectively. Determine:
i) Starting torque
ii) Slip at which maximum torque will occur
iii) Speed at which maximum torque will occur
iv) Maximum torque
v) Full load torque if full load slip is 4%.
Assume ratio of stator to rotor turns as 4. **(06 Marks)**

Module-3

5 a. Starting from the fundamentals develop the equivalent circuit of three phase induction motor. **(05 Marks)**

b. Explain the phenomenon of cogging and crawling in a 3 phase induction motor. **(05 Marks)**

c. Draw and explain the phasor diagram of a three phase induction motor. **(06 Marks)**

OR

6 a. What is induction generator? Discuss the principle of operation with the help of phasor diagram. **(06 Marks)**

b. 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, 11A, p.f. = 0.2
S.C. test: 100V, 25A, p.f. = 0.4
Rotor copper loss at stand still is half the total copper loss. From the circle diagram, find:
i) line current
ii) slip
iii) efficiency
iv) p.f. at full load
v) maximum torque. **(10 Marks)**

Module-4

7 a. Name the different methods of starting of squirrel cage induction motor. Explain star-delta starter of 3 phase squirrel cage induction motor with a suitable diagram. **(08 Marks)**

b. Describe any two methods of speed control of a 3-phase induction motor. **(08 Marks)**

OR

8 a. Explain double field revolving theory as applied to a single phase induction motor and prove that it cannot produce any starting torque. **(10 Marks)**

b. Describe the construction working and applications of shaded pole induction motor. **(06 Marks)**

Module-5

9 a. State the methods of starting synchronous motor. Explain any one in detail. **(05 Marks)**

b. Explain the operation of synchronous motor at constant load variable excitation. **(05 Marks)**

c. Explain the concept of hunting in synchronous motors. What are the methods to overcome this? **(06 Marks)**

OR

10 a. Explain the construction working, characteristics and application of a.c. servomotor. **(08 Marks)**

b. Explain the working of permanent magnet stepper motor and give some application. **(08 Marks)**

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