

Electric Motors VTU CBCS Question Paper Set 2018

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CBCS Scheme

USN

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15EE44

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 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 is back emf? Derive the armature torque equation of a DC motor. (06 Marks)
- b. List the applications of DC motors. (04 Marks)
- c. A 200V shunt motor with constant main field drives a load, the torque of which varies at the square of the speed. When running at 600 rpm, it takes 30A. Find the speed at which it will run and the current it will draw, if a 20Ω resistor is connected in series with the armature. Neglect the motor losses. (06 Marks)

OR

- 2 a. Draw the power flow diagram of a DC motor and derive the condition for minimum efficiency. (06 Marks)
- b. Explain the characteristics of a DC shunt motor. (05 Marks)
- c. Explain with circuit diagram, the armature control methods of DC series motors. (05 Marks)

Module-2

- 3 a. With neat diagram, explain the Swinburne's test on a DC motor. Mention the demerits of this test. (05 Marks)
- b. Explain the test on a DC motor which determines the rotational losses (05 Marks)
- c. Hopkinson's test on two machines gave the following results for full-load : line voltage = 230V, Line current excluding field current = 50A, motor armature current = 380A, field currents 5A and 4.2A. The armature resistance of each machine is 0.02Ω . Calculate the efficiency of each machine. (06 Marks)

OR

- 4 a. What is slip? Derive the maximum running torque equation of an induction motor. (06 Marks)
- b. Draw and explain the torque-slip characteristics covering motoring, generating and braking regions of operation. (06 Marks)
- c. Explain the effect of rotor resistance on maximum torque and slip of an induction motor. (04 Marks)

Module-3

- 5 a. Derive the approximate equivalent circuit referred to stator of an induction motor. (06 Marks)
- b. Explain with neat diagram the blocked rotor test on an induction motor. (05 Marks)
- c. The power input to the rotor of a 440V, 50Hz, 6-pole, 3-phase induction motor is 80kW. The rotor emf is observed to make 100 complete alternations per minute. Calculate the slip, the rotor speed and the mechanical power developed. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages

OR

- 6 a. Write the procedure of drawing the circle diagram. What information can be obtained from the circle diagram? (06 Marks)
- b. With neat diagram, explain the construction of rotor of a double cage induction motor. (05 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 neat diagram, explain the operation of a start – Delta starter. (06 Marks)
- b. Explain the stator voltage control of a three phase induction motor. (05 Marks)
- c. A squirrel cage induction motor has a full-load slip of 4% and blocked rotor current of 6 times the full-load current. Find the percentage of tapping of the auto-transformer starter to give full-load torque on starting and the line current as a percentage of full-load current. (05 Marks)

OR

- 8 a. Explain with double –revolving field theory why the single phase induction motor is not self starting with phasor diagram. (08 Marks)
- b. Explain with neat diagram, the working principle of capacitor start single phase induction motor. (08 Marks)

Module-5

- 9 a. Explain the operation of a synchronous motor under constant excitation and varying load. (06 Marks)
- b. What is a synchronous condenser? What is its application? (04 Marks)
- c. List the causes of hunting and effects of hunting in a synchronous motor. (06 Marks)

OR

- 10 a. With a neat diagram, explain the operation of a two-phase AC servomotor. (08 Marks)
- b. What is a linear induction motor? Explain its principle of operation and draw the torque speed characteristic. (08 Marks)

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CBCS Scheme

USN

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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 = 0.15Ω and field resistance = 250Ω . (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 = 0.3Ω .
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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