



CBGS SCHEME

18EE44

Fourth Semester B.E. Degree Examination, July/August 2021 Electric Motors

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Derive an expression for torque of a DC motor. (06 Marks)
b. With neat sketch explain Ward Leonard system of speed control. (06 Marks)
c. A 200V DC series motor runs at 800rpm, when taking a line current of 15A. The armature resistance and series field resistance are 0.6Ω and 0.4Ω respectively. Find the speed at which it will run when connected in series with a 5Ω resistance and taking the same voltage. (08 Marks)
- 2 a. What is the necessity of starter? Explain with neat sketch the four point starter. (08 Marks)
b. A DC shunt motor runs at 1000 rpm on 200V supply. Its armature resistance is 0.8Ω and the current taken is 40 amps, in addition to field current. What resistance must be connected in series with the armature, to reduce the speed to 600rpm, the armature torque remaining same? Neglect the armature reaction. (08 Marks)
c. Enumerate the various losses in a DC machine which of these losses
i) constant
ii) proportional to current
iii) proportional to current square. (04 Marks)
- 3 a. With a neat sketch, explain the importance and procedure of field test on DC motor. (06 Marks)
b. Explain the retardation test on DC machine. (06 Marks)
c. Discuss the complete torque-slip characteristics of three phase induction motor including motoring, generating and braking. (08 Marks)
- 4 a. Derive the torque equation of a three phase induction motor. (06 Marks)
b. In brake test conducted on an DC shunt motor the full load readings are observed as shown,
Tension on tight side = 9.1kg
Tension on slack side = 0.8kg.
Total current = 10A
Supply voltage = 110V
Speed = 1320rpm.
The radius of the pulley is 7.5cm calculate its full load efficiency. (06 Marks)
c. A field test on two mechanically coupled similar motors with their fields connected in series and with one machine running as motor and the other as a generator gave the following data.
Motor : Armature current 40A, armature voltage 200V, the drop across its field winding 15V.
Generator : armature current 32A, armature voltage 160V, the drop across field winding 15V.
The resistance of each armature is 0.4Ω , calculate the efficiency of each machine at this load. (08 Marks)

- 5 a. Draw and explain the phasor diagram of induction motor on load condition. (05 Marks)
 b. Explain the phenomenon of cogging and crawling in a three phase induction motor. (05 Marks)
 c. A 440V, 3 phase, 8 pole, 50Hz, 40KW, star connected three phase induction motor has the following parameters stator resistance = 0.1Ω . Stator reactance = 0.4Ω equivalent rotor resistance referred to stator = 0.15Ω , equivalent rotor reactance referred to stator = 0.44Ω . The stator core loss is 1250W while mechanical loss is 1000W. It draws a no load current of 20A at a pf. of 0.09 lagging. While running at a speed of 727.5rpm. Calculate :
 i) Input line current and pf
 ii) Torque developed
 iii) Output power
 iv) Efficiency use approximate equivalent circuit. (10 Marks)
- 6 a. With neat circuit diagram explain the equivalent circuit of a 3 phase induction motor. (08 Marks)
 b. Draw the circle diagram for a 20Hp 50Hz, 3-phase, star connected induction motor with the following data :
 No load test : 400V, 9A, 0.2pf lagging
 Block rotor test : 200V, 50A 0.4pf lagging.
 Determine the line current, efficiency and slip for full load condition from the circle diagram. (12 Marks)
- 7 a. Explain with neat sketch, auto transformer method and star delta starter of 3-ph squirrel cage induction motor. (12 Marks)
 b. With schematic connection diagram and phasor diagram, explain the construction and working of a capacitor start induction motor. (08 Marks)
- 8 a. Describe the construction and application of shaded pole induction motor with suitable diagram. (08 Marks)
 b. Explain the necessity of starter in 3-ph induction motor. (04 Marks)
 c. Explain double field revolving theory as applied to single phase induction motor. (08 Marks)
- 9 a. Sketch and explain V – curves and inverter V-curves of synchronous motor. (08 Marks)
 b. Explain the working, characteristics and application of universal motor. (06 Marks)
 c. A 2300V, 3-ph, star connected synchronous motor has a resistance of 0.2Ω per phase and a synchronous reactance of $2.2\Omega/\text{ph}$. The motor is operating at 0.5pf. leading with a line current of 200A. Determine the value of the generated emf per phase. (06 Marks)
- 10 a. A 6600V, star – connected, 3-ph synchronous motor works at constant voltage and constant excitation. Its synchronous impedance is $(2.0 + j20.0)\Omega/\text{phase}$. When the input is 1000KW, the power factor is 0.8 leading. Find the power factor when input is increased to 1500KW. (10 Marks)
 b. Explain with neat sketch the construction, working, characteristics and applications of AC servomotor. (10 Marks)