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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, May 2016
(2013 Scheme)
13.602 : INDUCTION MACHINES AND SPECIAL ELECTRICAL MACHINES (E)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions.

1. What is meant by slip of an induction motor ? Explain the importance of slip in the operation and performance of an induction motor.

2. Why reactance of the rotor varies greatly between staring and running conditions of an induction motor ?

3. Explain why the starting torque of a squirrel cage induction motor is low, although the current drawn from the line may be quite high in starting the motor.

4. What is an induction generator ? List out its merits and demerits.

5. Compare the value of current drawn from the lines by an induction motor when started with its stator winding star connected as against delta connected.

6. A 3-phase induction motor at normal speed is carrying about half the rated load. If one of the supply line fuses blows off, will the motor stop or continue running ? Explain.

7. Explain why a single phase induction motor does not develop a starting torque.

8. Explain why AC series motors are preferred for electric locomotives.

9. Explain the working of hybrid stepper motors.

10. Explain the advantages of brushless DC motors over brushed DC motors.

(10×2=20 Marks)

P.T.O.

PART – B

Answer **any one full** question from **each** Module.

Module – I

11. a) Sketch the torque-slip characteristics of a 3 phase induction motor indicating the starting torque, maximum torque and the operating region. How do starting and maximum torque vary with the rotor resistance ? **10**

b) A 3-phase, delta connected, 30 hp, 400 V, 50 Hz, 4 pole induction motor gave the following test data :

No load test : 400 V, 12 A, 1.2 KW

Short circuit test : 100 V, 40 A, 3 KW

Draw the circle diagram and find (i) Stator current and power factor at full load (ii) Starting torque (iii) Full load torque (iv) Maximum torque and (v) Efficiency at full load. **10**

OR

12. a) Derive relationship between rotor input power, rotor copper loss and power developed at the shaft of a 3-phase induction motor. **8**

b) A 3-phase, 4 pole, 60 kW, 50 Hz induction motor connected to rated supply voltage and running without load consumes 3 kW. When prevented from rotating it draws rated current at 30% rated supply and takes a power input of 4 kW. Assuming that under rated load conditions, the stator and rotor copper losses are equal and that the mechanical losses are 30% of the no load losses, determine (i) slip at rated load and (ii) starting torque of the motor with rated applied voltage. **12**

Module – II

13. a) Explain with the help of diagram, construction and principle of operation of a double cage induction motor. Draw its equivalent circuit and torque speed characteristics. **10**

b) The resistance values of a double cage induction motor for stator, outer and inner cages are 0.25, 1.0 and 0.15 Ω and reactance values are 3.5, 0.1 and 3Ω respectively. Find the starting torque in newton-metre if the phase voltage is 250 V and synchronous speed is 1500 rpm. **10**

OR

14. a) With the help of a neat diagram explain the operation of a star-delta starter to start a 3 phase induction motor. Also derive the relation between starting torque and full load torque in terms of starting current, full load current and slip at full load. **10**

b) A 15 kW, 4 pole, 50 Hz, 415 V, 3-phase induction motor runs at 1455 rpm on full load with an efficiency of 90% and a power factor of 0.86. If it takes 162 A on direct switching, find the ratio of starting torque to full load torque when started with a star-delta starter. **10**

Module – III

15. a) Using double-revolving field theory, explain why a single phase induction motor is not self starting. **10**

b) Draw the neat circuit diagram of a shaded pole induction motor and explain its working. Also write application of single phase induction motors. **10**

OR

16. a) With necessary diagrams, explain the construction and working principle of AC servo motors. Also, draw the performance characteristics. **10**

b) Explain with diagrams, the constructional details and working principle of single phase series motor. Draw the phasor diagram and performance characteristics. **10**

Module – IV

17. a) Explain different modes of operation of stepper motors. **10**

b) Explain with neat diagrams, the working principle of reluctance motors. **10**

OR

18. a) Explain with neat diagrams, the working principle of linear induction motors. List out the applications of such machines. **10**

b) Discuss the constructional details and working principle of BLDC motors. Indicate the merits and demerits. **10**