(Pages : 3) **N – 5882**

Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, April 2022

13.602 INDUCTION MACHINES AND SPECIAL ELECTRICAL MACHINES (E)

(2013 Scheme)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** carries **2** mark.

1. What is meant by slip of an induction motor? Explain why induction machines cannot run at synchronous speed?
2. A 3 phase, 50 Hz induction motor has a full load speed of 960 rpm. Calculate the number of poles and slip frequency.
3. Differentiate crawling and cogging in induction motors,
4. Explain the working of synchronous induction motor.
5. What is meant by V/f control of induction motors?
6. Why starters are necessary for starting of induction motors?
7. Explain principle of operation of universal motors.
8. Draw the torque slip characteristics of single phase induction motor.
9. Why rotor position sensor is essential for operation of SRM?
10. List out the applications of linear induction motors.

(10 × 2 = 20 Marks)

P.T.O.

PART – B

Answer any one **full** questions form each module. Each carries **20** marks.

Module I

11. (a) Derive the equivalent circuit of a 3 phase induction motor. **5**

(b) Derive the expression for mechanical power and torque of a three phase induction motor. **5**

(c) A 3 phase, 4 pole, 1440 rpm, 50 Hz induction motor has star connected rotor winding, having a resistance of 0.2 Ω per phase and a standstill leakage reactance of 1 Ω per phase. When the stator is energised at rated voltage and frequency, the rotor induced emf at standstill is 120 V per phase. Calculate (i) the rotor current (ii) rotor power factor (iii) starting torque and (iv) full load torque. **10**

OR

12. (a) Derive from first principles, the relation between power transferred to the rotor, mechanical power developed and copper losses in the rotor of a three phase induction motor and obtain the expression for torque developed in synchronous watts. **10**

(b) The real power input to a 415 V, 50 Hz, 6-pole, 3 phase induction motor running at 970 rpm is 41 kW. The input power factor is 0.9. The stator losses amount to 1.1kw and the mechanical losses total 1.2 kW. Calculate the (i) line current (ii) slip (iii) rotor copper loss (iv) mechanical power output and (v) efficiency. **10**

Module II

13. (a) Explain how a large starting torque can be obtained in a double cage induction motor. **4**

(b) Draw and explain the equivalent circuit of double cage induction motor. **6**

(c) Explain with the help of neat diagrams, the working of star-delta starter and auto-transformer starter for 3 phase induction motors. Also, explain a starting method for a wound rotor induction motor. **10**

OR

14. (a) Draw and explain the torque slip characteristic of double cage induction motor. **5**

(b) Explain different types of braking in induction motors. **5**

(c) Explain the principle of operation of induction generator. Draw the phasor diagram. **10**

Module III

15. (a) Explain the operation of single phase induction motor using double field revolving theory. **10**

(b) Explain with figures, the working of armature controlled and field controlled DC servomotors. **10**

OR

16. (a) Explain the methods for making single phase induction motors self-starting. **10**

(b) Explain with neat figures the constructional details and principle of operation of AC servomotors. Draw the torque — speed characteristics and explain. **10**

Module IV

17. (a) Derive the torque equation of reluctance motor. Draw the torque-slip characteristics and explain. **10**

(b) Explain with neat figures the constructional details and principle of operation of brushless DC motors. Explain how commutation is achieved without brushes and commutators. **10**

OR

18. (a) Explain the constructional details and characteristics of different types of stepper motors. **10**

(b) Explain with figures, the constructional details and principle of operation of different types of linear induction motors. **10**

(4 × 20 = 80 Marks)