

INDIAN MARITIME UNIVERSITY
Time Bound Assignment September/October 2020
B Tech (ME) Arrear Examinations
ELECTRICAL MACHINES - II
UG11T3404

Date: 26/09/2020

Maximum Marks: 70

Time: 3 Hrs

Pass Marks: 35

Part – A (compulsory)
Answer the following (10x2=20 Marks)

1. Why an induction motor cannot run at synchronous speed?
2. Define 'slip' and state the operating condition of induction machine when the slip is negative.
3. Explain why an induction machine is called a "Generalized transformer"?
4. What is the effect of variation of supply frequency in an induction motor?
5. What is V-curve for 3-phase Alternator?
6. A 4-pole induction motor is fed from 50-Hz supply. If the frequency of rotor emf at full-load is 2-Hz, find the full-load speed.
7. Why synchronous motor is not self-starting?
8. Why damper windings are used in a synchronous machine?
9. What is synchronous reactance for synchronous machine?
10. An alternator on open circuit generates 360 V at 60Hz when the field current is 3.6 A. Neglecting saturation, determine the open circuit emf when frequency is 40 Hz and the field current is 2.4 A.

Part – B

Answer any 5 out of 7 questions (5 x 10= 50 marks)

11. a) Draw the equivalent circuit of a 3-phase induction motor. **5 marks**
b) Show that in an induction motor, "air-gap power: mechanical power developed: rotor copper losses :: 1 : (1-s) : s", where s is the fractional slip. **5 marks**
12. a) Explain auto-transformer starter of three phase induction motor. **5 marks**

- b) A 53.62HP, 6-pole, 3-phase induction motor delivers full-load output at 950 rpm and with 0.85 pf when connected to 500 V, 50-Hz. Friction and windage losses equal 1.5 kW and stator losses are 1.8 kW. Determine for this load (i) rotor copper loss and (ii) efficiency. **5 marks**

13. a) If stator impedance of an induction motor is neglected then show that $\frac{T_e}{T_{\max}} = \frac{2}{\frac{s_{mt}}{s} + \frac{s}{s_{mt}}}$ where, T_{\max} is maximum torque and s_{mt} is the slip at maximum torque. **5 marks**

- b) A 3-phase, 4- pole induction motor delivers 37 HP at the shaft at a speed of 1425 rpm on 500V, 50-Hz supply. The mechanical losses total 3 Hp and the power factor is 0.9. Calculate for this load (i) the slip (ii) the rotor copper loss (iii) the total power input if the stator losses are 2500W (iv) the efficiency (v) the number of complete cycles per minute of the rotor emf. **5 marks**

14. a) Explain double revolving field theory of single-phase induction motor. **5 marks**
 b) Calculate the values of resistance elements of a 4-step starter for a 3-phase, 400 V, wound-rotor induction motor. The full-load slip is 3% and the maximum starting current is limited to its full-load value. Rotor resistance per phase is 0.015 ohm. **5 marks**

15. a) Derive an expression for distribution factor of a winding having q slots per pole per phase and a slot angle of β . **5 marks**
 b) Derive an expression for emf generated per phase in 3-phase Alternator. **5 marks**

16. a) Explain briefly "hunting of synchronous machines. **5 marks**
 b) A 6.6kV, 3-phase, star-connected synchronous motor draws a full-load current of 60A at 0.8 pf leading. The armature resistance and reactance per phase are 2.2 ohm and 22 ohm respectively. Total stray losses are 25 kW. Calculate (i) efficiency of the machine and (ii) emf induced. **5 marks**

17. a) Discuss about the conditions necessary for paralleling of two three phase alternators. **5 marks**
 b) A 3-phase, 50 Hz, 415 V, star connected synchronous machine operates at rated voltage and at a leading pf of 0.9. Shaft power is 15 kW and the excitation emf is 400 V. If per-phase resistance is 0.5 ohm, find the synchronous reactance, neglect mechanical losses of the system. **5 marks**

* * * * *