Indian Maritime University

(A Central University, Govt of India)

Supplementary Examinations – September/October 2024

Programme Name: B Tech (ME)

Semester: Fourth

Subject Code: UG11T3404

Subject Name: ELECTRICAL MACHINES II

Date: 09.09.2024 Max Marks: 70

Duration: 03 Hrs Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.

(ii) Options, if any, are specified in respective section.

Section A

Answer all the questions (10x1=10)

1. An 8-pole, 3-phase, 50 Hz induction motor is operating at a speed of 720 rpm. The frequency of the rotor current of the motor in Hz is _____
   (A) 2
   (B) 4
   (C) 3
   (D) 1

2. An induction motor is identical to
   (A) D.C. compound motor
   (B) D.C. series motor
   (C) Synchronous motor
   (D) Asynchronous motor

3. Where resistance is added in the rotor circuit of a slip ring induction motor
   (A) The starting torque and current both reduce
   (B) The starting torque and current both increase
   (C) The starting current reduces but starting torque increase
   (D) None of the above

4. A 3- phase synchronous motor can operate over a wide range of power factors i.e. from lagging to leading power factor. This is achieved by
   (A) varying the speed.
   (B) changing the field excitation.
   (C) varying the applied voltage.
   (D) changing the load.

5. Power factor of a synchronous motor varies when the _____
   (A) applied voltage is varied
   (B) load is changed
   (C) supply frequency and field excitation is changed
   (D) all of the mentioned

6. The armature current is _____ at UPF when compared to leading power factor.
   (A) minimum
   (B) maximum
   (C) equal
   (D) none of the mentioned

7. An V-curve of synchronous motor shows the variation of
   (A) Armature current and field current at constant load
   (B) supply voltage and field current at constant excitation
   (C) power factor and supply voltage during hunting
   (D) all of the above

8. What will happen if the relative speed between the rotating flux of stator and rotor of the induction motor is zero?
   (A) The slip of the motor will be 5%
   (B) The rotor will not run
   (C) The rotor will run at very high speed
   (D) The torque produced will be very large

9. A stepping motor is a _____ device.
   (A) mechanical
   (B) electrical
   (C) analogue
   (D) incremental

10. Reluctance motor can produce torque at _____
   (A) any speed less than synchronous speed
   (B) synchronous speed only
   (C) any speed greater than synchronous speed
   (D) all of the mentioned

Section B

Answer all the questions (5x2=10)

11. Why synchronous motor is not self starting?
12. What is the condition for maximum torque in induction motor?
13. What is the effect on speed if the load is increased on a 3 phase synchronous motor?
14. What is the purpose of connecting external resistors to slip ring Induction motor?

15. What are different types of stepper motor?

Section C

Answer any five questions (5x10=50)

16. (a) Derive the Condition of Maximum Torque Under Running Conditions in case of Induction motor. [5]

(b)Show the magnitude of Rotating Magnetic Field (RMF) is 1.5 times the maximum value of value of flux. [5]

17. Draw the Torques-speed characteristics of Induction motor and show all the operating regions including motoring, generating and braking. [10]

18. A 4-pole, 50-Hz, 3-φ induction motor develops a maximum torque of 162.8 N-m at 1365 r.p.m. The resistance of the star-connected rotor is 0.2 Ω/phase. Calculate the value of the resistance that must be inserted in series with each rotor phase to produce a starting torque equal to half the maximum torque. [10]

19. (a) How power factor factor can be increased with the help of synchronous condenser. Please explain with proper phasor diagram. Also add the advantages of using synchronous condenser [5]

(b) Explain the double-revolving field theory related to single phase Induction motor. [5]

20. Describe the synchronising procedure using dark lamp and bright lamp methods. [10]

21. (a) Explain the construction and working principle of stepper motor. [4]

(b) A synchronous motor absorbing 60 kW is connected in parallel with a factory load of 240 kW having a lagging p.f. of 0.8. If the combined load has a p.f. of 0.9, what is the value of the leading kVAR supplied by the motor and at what p.f. is it working ? [6]

22. What is BLDC. Explain the working principle of BLDC. What are the advantages of using BLDC comopared to normal DC motor. [10]