Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – December 2025

Programme Name: B Tech (ME)

Semester: V

Subject Code: UG11T4508

Subject Name: Marine Electrical Motors: Starters and Drive Controls

Date: 22.12.2025	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

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. Why is slip an essential feature in the operation of an induction motor?
   a. It prevents excessive heating of the stator windings
   b. It ensures that the rotor rotates exactly at synchronous speed
   c. It provides the necessary relative motion between the rotating magnetic field and the rotor conductors
   d. It helps maintain synchronism between the rotor current frequency and the supply frequency

2. Why must a DC series motor never be started without load?
   a. Because it draws excessive current at no load
   b. Because its speed may increase dangerously high due to very low back emf
   c. Because the field flux becomes too strong, causing instability
   d. Because the armature voltage drops to zero

3. The speed of a D.C. shunt motor more than its full-load speed can be obtained by
   a. decreasing the field current
   b. increasing the field current
   c. decreasing the armature current
   d. increasing the armature current

4. Why is a star–delta starter used for starting large three-phase induction motors instead of a DOL starter?

a. It reduces the starting current and torque
b. It increases the starting torque
c. It keeps the torque constant
d. It prevents excessive voltage drop in the supply line

5. What will happen if the back emf of a DC motor vanishes suddenly?
a. The motor will stop
b. The motor will continue to run
c. The armature may burn
d. The motor will run noisy

6. The term "cogging" is associated with
a. Three-phase transformers
b. Compound generators
c. D.C. series motors
d. Induction motors

7. What is a key advantage of using IGBTs for motor speed control?
a. High efficiency at low current only
b. High-frequency switching with high current capability
c. They reduce motor torque permanently
d. Fixed-speed operation

8. The torque developed by an induction motor is directly proportional to:
a. Slip (s)
b. (1 - s)
c. Rotor current squared multiplied by rotor resistance
d. Stator current only

9. During the maintenance of a cage type 3-phase induction motor, which of the following is of primary importance?
a. Checking dampness, condensation, and ensuring proper airflow
b. Inspecting dust and oil accumulation on external and internal surfaces
c. Cleaning, inspecting, and lubricating the bearings
d. Painting over the insulation to protect it

10. During maintenance of starters and controllers, which of the following is checked to prevent faults?
a. Painting of the starter casing
b. Motor rotor winding only
c. Ambient lighting in the motor room
d. Contactor faces, spring tension, and lubrication

Section B

Five Questions of 02 Marks each. Answer all questions.

11. What is under-voltage protection?

12. What factors influence synchronous motor speed?

13. State the fundamental reason for installing protective devices on motors.

14. What is the V/Hz ratio in induction motors, and why is it maintained constant?

15. State the marine applications of induction motors for: (i) Single fixed speed; (ii) Infinitely variable speeds.

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. (a) Draw and explain the torque-slip characteristic curve of a 3-phase induction motor. (6 Marks)

(b) A DC shunt motor is connected to a 220 V supply. The armature resistance is 0.5 Ω. The motor develops a back EMF of 200 V. If the motor speed is 1500 rpm, calculate the armature current and the torque developed. (4 Marks)

17. Explain the working of following motor starters using a neat sketch:
(i) 3-point DC Motor Starter
(ii) auto-transformer starter used for 3-phase induction motor. (10 Marks)

18. (a) What is single phasing in a three-phase induction motor, and what are its effects? (3 Marks)

(b) A 12 kW, 3-phase, 6 pole, 50 Hz, 400 V, delta-connected induction motor runs at 960 rpm, on full-load. If it takes 85 A on direct starting, find the ratio of starting torque to full-load torque with a star-delta starter. Full-load efficiency and power factor are 88% and 0.85 lagging, respectively. (7 Marks)

19. (a) Describe the most common causes of failure of insulations for electrical machines on ship. (5 Marks)
(b) Write the safety guidelines for the maintenance and repair of electrical motor starters on ships. (5 Marks)

20. With a suitable block diagram, explain the working of servo motor. Detail how a servo motor is controlled along with its applications. (10 Marks)

21. Explain the Ward-Leonard method of speed control for a DC motor. Also, list its advantages and disadvantages. (10 Marks)

22. (a) What is the function of the under-voltage release mechanism in a marine generator? Where is it fitted, and why is it necessary? (6 Marks)

(b) Write short notes on the advantages and drawbacks of Insulated Gate Bipolar Transistors (IGBTs) when used in variable speed drives. (4 Marks)