Indian Maritime University

(A Central University, Govt of India)

Mar/Apr'26 SE

Programme Name: B Tech (ME)

Semester: III

Subject Code: UG11T4307

Subject Name: Electrical Machines

Date: 27.04.2026	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 (10 x1=10 Marks)

1. The synchronous motor operates at _____ when it is loaded.
   (A) less than synchronous speed
   (B) more than synchronous speed
   (C) synchronous speed
   (D) zero speed

2. When controlling the speed of a DC shunt motor above its rated speed, which of the following methods is preferred?
   (A) Field-current control method
   (B) Armature-voltage control method
   (C) Ward Leonard control method
   (D) Both (A) and (B)

3. One can ascertain the direction of rotation of a DC motor conductor by using _____.
   (A) Ampere's law
   (B) Fleming's left hand rule
   (C) Fleming's right hand rule
   (D) Faraday's law

4. A 3-phase 400 V, 60 Hz induction motor has 3% slip. The frequency of rotor current will be
   (A) 60 Hz
   (B) 30 Hz
   (C) 0.6 Hz

(D) 1.8 Hz

5. When a wide range of speed control and high starting torque must be achieved, which of the following motors is used?

(A) DC motor
(B) 1-Phase induction motor
(C) 3-Phase squirrel cage induction motor
(D) Synchronous motor

6. The direction of rotation of a synchronous motor can be changed by reversing _____.

(A) the field winding current
(B) polarity of rotor poles
(C) supply phase sequence
(D) all the above

7. DC machines with lap winding will have _____.

(A) low current and low voltage
(B) high current and high voltage
(C) high current and low voltage
(D) low current and high voltage

8. Power-factor corrections can be achieved using _____.

(A) 3-phase induction motor with DOL starter
(B) over-excited synchronous motor
(C) 3-phase induction motor with star-delta starter
(D) under-excited synchronous motor

9. The inverted V-curves of a synchronous motor shows relationship between

(A) Excitation current and back e.m.f
(B) Field current and power-factor
(C) field current and A.C. armature current
(D) Armature current and supply voltage

10. Which of the following shows the value PI for Large Power Transformer?

(A) IR at 10 min to IR at 1 min
(B) IR at 60 sec to IR at 15 sec
(C) IR at 1 min to IR at 10 min
(D) IR at 15 sec to IR at 60 sec

Section B

Answer all the questions (5 x 2=10 Marks)

11. What is back E.M.F. in DC motor? Give its significance.
12. State the various types of motor enclosures. Also, make a note on the I.P. Protection.

13. Discuss the plugging method of electric braking in DC motors.

14. Explain the advantages of employing a high-voltage system aboard ships.

15. What is meant by "hunting of synchronous motor"?

Section C

Answer any five questions (5x10=50)

16. Give the constructional details of a DC motor using a clear sketch. Also, write the voltage equation for the DC shunt motor. (7 + 3)

17. (a) A 4- Pole DC motor has lap connected armature winding with flux of 0.5 Weber. The number of conductors is 250. When connected to 230 V DC supply, it draws an armature current of 30 A. Calculate the back e.m.f. and speed with which motor is running. Assume armature resistance of 0.6 Ω. (6)

(b) Why should a DC series motor never be started without a load? (4)

18. With a simple illustration, explain how the Star-Delta starter and DOL starter work in a three-phase squirrel cage induction motor. (5 + 5)

19. An 8-pole, 3-phase, 50 Hz induction motor is running at full load with a slip of 5%. The rotor is star connected and its per phase resistance and standstill reactance are 0.35 Ω and 2 Ω respectively. The EMF between slip rings is 150 V. Determine the rotor current per phase and rotor power factor. Assuming the slip rings are short circuited. (10)

20. A synchronous motor absorbing 50 kW is connected in parallel with a factory load of 200 kW having a lagging power factor of 0.8. If the combination has a power factor of 0.9 lagging, find the kVAR supplied by the motor and its power factor. (10)

21. (a) What are the causes of shipboard blackouts and how should they be handled? (4)

(b) Sketch and describe the synchronous motor's V-curves. (6)

22. Explain the isolation procedure, while working on High voltage equipment and explain why the I.R. and P.I. tests are crucial for high-voltage equipment. (5 + 5)