

**Indian Maritime University**  
**(A Central University, Govt of India)**  
**End Semester Examinations – December 2022**  
**Programme Name: B Tech (ME)**  
**Semester: Third**  
**Subject Code: UG11T4307**  
**Subject Name: Electrical Machines**

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Date: 19.12.2022

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

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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 Marks)**

1. Slip of an induction motor is negative when
  - (A) Magnetic field and rotor rotate in opposite direction
  - (B) Rotor speed is less than the synchronous speed of the field and are in the same direction
  - (C) Rotor speed is more than the synchronous speed of the field and are in the same direction
  - (D) None of the above
2. A 3-phase 440 V, 50 Hz induction motor has 3% slip. The frequency of rotor current will be
  - (A) 50 Hz
  - (B) 25 Hz
  - (C) 1.5 Hz
  - (D) 2 Hz
3. For machine tools, which DC motor can be used?
  - (A) DC Series motor
  - (B) DC Shunt motor
  - (C) DC cumulative compound motor
  - (D) DC differential compound motor
4. Insertion of reactance in the rotor circuit
  - (A) Reduces starting torque as well as maximum torque
  - (B) Increases starting torque as well as maximum torque

- (C) Increases starting torque but maximum torque remains unchanged  
(D) Increases starting torque but maximum torque decreases
5. The V-curves of a synchronous motor show relationship between  
(A) Excitation current and back e.m.f  
(B) Field current and p.f.  
(C) field current and A.C. armature current  
(D) Armature current and supply voltage
6. Slip ring motor is preferred over squirrel cage induction motor where \_\_\_\_\_  
(A) high starting torque is required  
(B) load torque is heavy  
(C) heavy pull out torque is required  
(D) all of the above
7. Ward-Leonard control is basically a \_\_\_\_\_ control method.  
(A) Field control.  
(B) Armature resistance control.  
(C) Armature voltage control.  
(D) Field diverter control.
8. Lap winding is preferred for which type of machines?  
(A) low current and low voltage  
(B) high current and high voltage  
(C) high current and low voltage  
(D) low current and high voltage
9. When load on a normally-excited synchronous motor is increased, its power factor tends to  
(A) Approach unity  
(B) Becomes increasingly lagging  
(C) Becomes increasingly leading  
(D) Remain unchanged
10. Which of the following ration of IR used to determine the value PI of 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 (5x2=10 Marks)**

11. What will be the effect of reducing the flux value on speed and torque in case of dc series motor?

12. Why the efficiency of a three-phase induction motor is less than that of a three-phase transformer?
13. How the synchronous motor can be used as a synchronous condenser?
14. Explain the terms: Normal excitation, over excitation and under excitation considering the case of synchronous motor?
15. Explain the benefits of using high voltage system on ships.

### Section C

**Answer any five questions (5x10=50 Marks)**

16. Explain the working of following starter used in Squirrel cage induction motor with neat diagram
  - (a) Star-Delta Starter [4]
  - (b) Auto Transformer Starter [3]
  - (c) DOL Starter [3]
  
17. A 440-V, 3- $\phi$ , 50-Hz, 4-pole, Y-connected induction motor has a full-load speed of 1425 rpm. The rotor has an impedance of  $(0.4 + j 4)$  ohm and rotor/stator turn ratio of 0.8. Calculate
  - (a) starting torque and full-load torque [4]
  - (b) power output if windage and friction losses amount to 500 W [3]
  - (c) maximum torque and the speed at which it occurs [3]
  
18. 250 V, d.c. shunt motor has an armature resistance of  $0.5 \Omega$  and a field resistance of  $250 \Omega$ . When driving a load of constant torque at 600 r.p.m., the armature current is 20 A. If it is desired to raise the speed from 600 to 800 r.p.m., what resistance should be inserted in the shunt field circuit? Assume that the magnetic circuit is unsaturated. [10]
  
19. What is V and inverse V curve in synchronous motor? Explain with proper neat diagram. [10]
  
20. What is Ward-Leonard method of speed control? Explain the advantage and disadvantage of this method. [10]
  
21. Explain the role of insulation resistance and polarization Index on high voltage equipment. Explain the working principle of megger tester with neat and clean diagram. [10]
  
22. 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? [10]

