

**Indian Maritime University**  
**(A Central University, Govt of India)**  
**End Semester Examinations – December 2022**  
**Programme Name: B Tech (ME)**  
**Semester: Fourth**  
**Subject Code: UG11T3404**  
**Subject Name: ELECTRICAL MACHINES II**

Date: 30.11.2022

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.
- (iii) Tables (Steam/Log/Nautical Almanac etc) that can be used.
- (iv) Chart Work Booklets to be used.

**Section A**

**Answer all the questions (10x1=10)**

1. DOL starting of induction motors is usually restricted to
  - (A) Low horsepower motors
  - (B) Variable speed motors
  - (C) High horsepower motors
  - (D) High speed motors
  
2. A 3-phase 440 V, 50 Hz induction motor has 4% slip. The frequency of rotor e.m.f. will be
  - (A) 200 Hz
  - (B) 50 Hz
  - (C) 2 Hz
  - (D) 0.2 Hz
  
3. In three-phase squirrel-cage induction motors
  - (A) Rotor conductor ends are short-circuited through slip rings
  - (B) Rotor conductors are short-circuited through end rings
  - (C) Rotor conductors are kept open
  - (D) Rotor conductors are connected to insulation
  
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. A synchronous motor is supplying a load at unity power factor. If the load on the motor is increased keeping its excitation and terminal voltage constant, the power factor
- (A) will remain the same
  - (B) will become leading
  - (C) will become lagging
  - (D) none of the above
6. Synchronous capacitor is
- (A) an ordinary static capacitor bank
  - (B) an over excited synchronous motor driving mechanical load
  - (C) an over excited synchronous motor without mechanical load
  - (D) none of the above
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. The induction generator works between the slip -
- (A)  $1 < S < 2$
  - (B)  $0.1 < S < 1$
  - (C)  $S < 0$
  - (D) None of these
9. A stepping motor is a \_\_\_\_\_ device.
- (A) mechanical
  - (B) electrical
  - (C) analogue
  - (D) incremental
10. A switched reluctance motor differs from a VR stepper motor in the sense that it
- (A) has rotor poles of ferromagnetic material
  - (B) rotates continuously
  - (C) is designed for open-loop operation only
  - (D) has lower efficiency.

**Section B**

**Answer all the questions (5x2=10)**

11. What happens when the Induction motor runs at synchronous speed?  
12. When does a synchronous motor get over-excited?

13. What does hunting of synchronous motor mean?  
14. Explain detent torque in a stepper motor.  
15. Why is the synchronous impedance method of estimating voltage regulation considered a pessimistic method?

**Section C**

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

16. (a) Explain torque-slip characteristics of three-phase induction motor. [5]  
(b) Describe the analogy of induction motor with the transformer in detail. [5]
17. Prove that the magnetic field produced by three-phase winding in an induction motor is rotating in nature and its magnitude is 1.5 times the maximum flux value ( $\Phi_m$ ).
18. A 50-kW 440-V 50-Hz two-pole induction motor has a slip of 6% when operating at full-load conditions. At full-load conditions, the friction and windage losses are 520 W, and the core losses are 500W. Find the following values for full-load conditions:
- (a) The shaft speed in rpm [4]  
(c) The load torque in newton-meters [3]  
(d) The induced torque in newton-meter [3]
19. (a) Draw and explain the V-curve and Inverted V-curve of a synchronous motor. [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 working principle of two-phase ac servomotor with torque speed characteristics. [4]  
(b) An alternator is supplying a load of 300 kW at a p.f. of 0.6 lagging. If the power factor is raised to unity, how many more kilowatts can alternator supply for the same kVA loading? [6]
22. A stepper motor has a step angle of  $2.5^\circ$ . Calculate the number of steps required for the shaft to make 25 revolutions. [10]

