

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations– June 2023
Programme Name: B Tech (ME)
Semester: IV
Subject Code: UG11T3404
Subject Name: Electrical Machines II

Date: 06.06.2023

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

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable. **(10X1 =10)**

1. If the field of the synchronous motor is overexcited then its power factor will be
 - a) Lagging
 - b) Leading
 - c) Unity
 - d) Zero
2. The stator core of a 3- phase induction motor is laminated in order to reduce the
 - a) Eddy current loss
 - b) Hysteresis loss
 - c) Both eddy current and hysteresis I loss
 - d) Weight of the stator
3. In a synchronous motor, the phenomenon of hunting caused by the sudden application or removal of load is prevented by
 - a) Using damper winding
 - b) Using a capacitor
 - c) Using an inductor
 - d) All of the above
4. Uneven gap in an induction motor is likely to cause

- a) Heating of motor
 - b) Unbalancing of motor shaft
 - c) Both (a) and (b)
 - d) None of these
5. The impedance angle ($^{\circ}$) of a synchronous motor is equal to
- a) $\tan^{-1} X_s / R_a$
 - b) $\tan^{-1} R_s / X_a$
 - c) $\tan^{-1} X_s / Z_a$
 - d) $\tan^{-1} Z_s / R_a$
6. Which of the following data is required to draw the circle diagram for an induction motor?
- a) Block rotor test only
 - b) No load test only
 - c) Block rotor test and no-load test
 - d) Block rotor test, no-load test and stator resistance test
7. If the load on a synchronous motor increases then its
- a) Current drawn by motor increases and load angle decreases
 - b) Current drawn by motor decreases and load angle remains constant
 - c) Current drawn by motor remains constant and load angle increases
 - d) Current drawn by motor increases and load angle also increases
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. The induction generator works between the slip -
- a) $1 < S < 2$
 - b) $0.1 < S < 1$
 - c) $S < 0$
 - d) None of these
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

Five Questions of 02 Marks each **(5X2 =10)**

11. What is the main difference between salient pole rotor and cylindrical rotor of a synchronous generator?
12. Explain detent torque in a stepper motor.
13. A 3-phase induction motor runs at almost 1000 rpm at no load and 950 rpm at full load when supplied with power from a 50 Hz, 3-phase supply. What is the corresponding speed of the rotor field with respect to the rotor?
14. Why is the MMF method of estimating the voltage regulation is considered as the optimistic method?
15. 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?

Section C

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

(10X5=50)

16. (a) 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 (Φ_m). (10)
- 17.(a) A 20 kVA, 400 V, 50 Hz three phase star connected synchronous generator has effective armature resistance and synchronous reactance $0.5 \Omega/\text{phase}$ and $3 \Omega/\text{phase}$ respectively. Voltage regulation for 0.8 leading power factor at full load is? (5)
- (b) Find out the excitation voltage expression of cylindrical rotor synchronous generator at leading power factor condition? (5)
- 18.(a) Draw and discuss about V curve and Inverted V curve of synchronous motor ? (5)
- b) A 3 phase, 50 Hz, 8 -pole alternator has a star connected winding with 120 slots and 8 conductor per slots. The flux per pole is 0.05 wb , sinusoidally distributed. Determine the phase and line voltages. (5)
19. (a)What are the major parts of 3 phase induction motor? Write briefly about them? (5)
- (b)A 3 phase, 50 Hz, 4-pole induction motor has a slip of 4 % and rotor has a resistance of 1 ohm and standstill reactance of 4 ohm, Calculate (i) speed of the

motor (ii) power factor at stand still and (iii) Power factor at a speed of 1400 rpm. (5)

20. (a) Explain the double-revolving field theory related to single phase Induction motor. (5)

(b) A 4 pole 3 phase 50 Hz induction motor develops a maximum torque of 30 Nm at 960 rpm. Determine the torque exerted by motor at 5% slip. The rotor resistance per phase is 0.6 Ohm. (5)

21.(a) What are torque slip characteristics and how the torque is varied with different values of slip of 3 phase induction motor? (5)

(b) It is desired to install a 3 phase cage induction motor restricting the maximum line current drawn from a 400V, 3 phase supply to 120 A. If the starting current is 6 times full load current what is the maximum permissible full load KVA of the motor when (i) it is directly connected to the mains (ii) it is connected through an auto transformer with a tapping of 60 % (iii) it is designed for use with star-delta starter. (5)

22. (a) Write down the operation and characteristics of split phase induction motor? (5)

(b) Explain the working principle of two-phase ac servomotor with torque speed characteristics. (5)