

INDIAN MARITIME UNIVERSITY

June 2022 End Semester Examinations

Programme Name: B Tech (Marine Engineering)

Semester: IV

Subject Name: Electrical Machines II; Sub Code: UG11T3404

Max Marks: 70

Pass Marks :35

Date – 07.06.2022

Duration – 03 Hours

Part A – Q.No.1; 10 MCQs (10 X 01 Mark)

- (I) The shaft of an induction motor must be of
- Solid
 - Hollow
 - Flexible
 - Any of the above
- (II) A 3-phase 440 V, 50 Hz induction motor has 4% slip. The frequency of rotor current will be
- 50 Hz
 - 25 Hz
 - 5 Hz
 - 2 Hz
- (III) In a three-phase induction motor, the number of poles in the rotor winding is always
- Equal to the number of poles in the stator
 - Zero
 - More than the number of poles in the stator
 - Less than the number of poles in the stator
- (IV) At standstill condition the value of slip is
- 0
 - Infinity
 - One
 - None of the above
- (V) For starting of an induction motor, star/delta starting can be considered equivalent to an autotransformer starter with the ratio of
- 33.3%
 - 50%
 - 100%
 - 57.7%
- (VI) What happens if the field winding of the synchronous motor is short-circuited?
- First, starts as induction motor then run as synchronous motor
 - Not start
 - Motor will burn out
 - Run as induction motor
- (VII) In a synchronous motor, hunting occurs due to _____
- Over excitation

- b. Periodic variation
- c. Over-loading for long periods
- d. Small and constant load

(VIII) Drop-in alternator frequency is corrected by:

- a. Automatic Voltage Regulator
- b. Damper Winding
- c. Increase Prime Mover Output
- d. Decrease Prime Mover Output

(IX) In the case of the leading power factor, the terminal voltage of the alternator will

- a. Rise on adding the full Load
- b. Rise on removing the full load
- c. Fall on adding the full load
- d. Fall on removing the full load

(X) A 10 pole AC generator rotates at 1200 rpm. The frequency of AC voltage in cycles per second will be

- a. 120
- b. 60
- c. 160
- d. 100

Part B – Q.No.2; 5 Short Questions (05 X 02 Marks)

(I) Why is the starting torque of a squirrel-cage induction motor low?

(II) Why is in an induction motor, no-load the slip generally less than 1%?

(III) Why does a small air gap in 3-phase induction motor help to reduce magnetizing effect?

(IV) What is happen to the synchronous motor when the excitation of an unloaded salient-pole synchronous motor suddenly gets disconnected?

(V) Why does the output frequency of an alternator depend on Number of poles and Rotational speed?

Part C – 7 Long Questions-Answers Any 5 (05 X 10 Marks)

(3) (a) Discuss the differences between 3-phase induction motors and transformers. 3 Marks

(b) Show that the maximum internal torque developed by a poly-phase induction motor does not depend on the rotor circuit resistance. 7 Marks

(4) (a) A 500 V, 3-phase, 50 Hz supply, 4 pole induction motor delivers 27.602 kW at the shaft at a speed of 23.75 rps. The mechanical losses total 2.238 kW and the power factor is 0.9. Calculate for this load: the slip; the rotor copper loss; the total power input if the stator losses are 2.5kW; the efficiency; the line current; the number of complete cycles per minute of the rotor emf. 5 Marks

- (b) Calculate the relative values of starting currents and starting torques of a 3-phase squirrel-cage induction motor, when it is started by auto-transformer starter. 5 Marks
- (5) (a) Explain the Double Revolving Field Theory of Single Phase Induction Motor. 5 Marks
- (b) The test results of a 230 V, single-phase induction motor are given below:
Blocked rotor test: 110 V, 9.5 A, 450 W.
No-load test: 230 V, 4.4 A, 120 W.
The starting winding is kept open during blocked rotor test and stator winding resistance is 1.4 ohm. Find the equivalent circuit parameters of the motor. 5 Marks
- (6) (a) Explain the construction of three-phase synchronous motor. 5 Marks
- (b) Design the 7-notches or studs rotor starter for a three-phase wound induction motor. The slip at full load current is 1% and the maximum starting currents is 3 times full-load current. The resistance of rotor is 0.02 ohm per phase. 5 Marks
- (7) (a) What is alternator voltage regulation? State the advantages and limitation of synchronous impedance method of determining the alternator voltage regulation. 5 Marks
- (b) A 3-phase, 50 Hz, star-connected, 2000kVA, 2300V alternator gives a short-circuit current of 600A for a certain field excitation. With the same excitation, the open circuit voltage is 900V. The resistance between a pair of terminal is 0.12 ohm. Find the full-load regulation at 0.8 power factor lagging and 0.8 power factor leading. 5 Marks
- (8) (a) Derive an expression of synchronizing power for salient pole alternator. 5 Marks
- (b) A 3-phase, 400V, star-connected synchronous motor has an effective armature resistance and a synchronous reactance per phase of 0.2 ohm and 2 ohm respectively. It takes 20 A to drive a certain load. Calculate the excitation emf induced in the motor if it works with 0.8 power factor lead and unity power factor conditions. 5 Marks
- (9) (a) Why is it necessary to run alternators in parallel? 3 Marks
- (b) Two single phase alternators operating in parallel have induced emfs on open circuit of $220\angle 0^\circ$ and $220\angle 10^\circ$ V and respective resistances of $j3$ ohm and $j4$ ohm. Calculate:- terminal voltage; currents and power delivered by each of the alternators to load resistance 6 ohm. 7 Marks