INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

MAY/JUNE 2018 END SEMESTER EXAMINATION

B.Tech (Marine Engineering)

Semester: IV

Electrical Machines – II (UG11T1404/ UG11T2404)

Date: 15-06-2018 Maximum Marks:100

Time: 3 Hrs Pass Marks: 50

Part A (10 × 3 = 30 Marks)

All Questions are compulsory

1. (a) What is called rotating magnetic field?

   (b) Define synchronous watt.

   (c) A 6 – pole, 50 – Hz, 3 – phase induction motor is running at 950 rpm and has rotor cu – loss of 5 kW. Calculate the rotor input.

   (d) Why skewing of rotor bars has done in squirrel cage induction motor (SCIM)?

   (e) Define breakdown torque in SCIM.

   (f) Why centrifugal switch is used in 1 – phase induction motor?

   (g) Define synchronous reactance.

   (h) Why synchronous motors are not self – starting?

   (i) List the conditions for synchronization.

   (j) Define voltage regulation in alternator.

Part B (5 × 14 = 70 Marks)

Answer any five of the following

2. (a) Why does the rotor of SCIM rotate, when the stator is connected to 3 – phase supply? (7)

   (b) A 3 – phase induction motor is wound for 4 poles and is supplied from 50 Hz system. Calculate (i) the synchronous speed (ii) the rotor speed when the slip is 4% and (iii) rotor frequency when rotor runs at 600 rpm. (7)

3. (a) Show that Rotor input : Rotor Gross output : rotor cu loss :: 1: (1 – s): s. (7)

(b) A 3- phase, star connected 400 V, 50 – Hz , 4 – pole induction motor has the following per phase parameters in ohms, referred to stator.
$R_1 = 0.15$, $X_1 = 0.45$, $R_2' = 0.12$, $X_2' = 0.12$, $X_m = 28.5$.
Compute the stator current and power factor when the motor is operated at rated voltage and frequency with s = 0.04. (7)

4. (a) Derive the expression for maximum torque developed by an induction motor under running condition. Show that the maximum torque occurs at a slip $s = R_2/X_2$ and further show that T_{max} is independent of s. (7)

(b) A 3 – phase induction motor has a starting torque of 100% and a maximum torque of 200% of the full – load torque. Find (i) slip at maximum torque, (ii) full – load slip, and (iii) ratio of rotor current at starting to full – load rotor current. (7)

5. (a) Show that in star/delta starting of squirrel cage induction motor the starting current and torque are reduced by a factor of 1/3 compared to DOL Starting. (7)

(b) Explain why a single phase single winding induction motor produces no starting torque. How it is made as self-starting motor? (7)

6. (a) Obtain the equation of induced emf per phase in an alternator. (7)

(b) Find the value of $K_d$for an alternator with 9 slots per pole for the following (i) One winding in all slots (ii) One winding using only the first 2/3 of the slots/pole (iii) three equal windings placed sequentially in 60^0 group. (7)

7. (a) Discuss synchronous impedance method for finding voltage regulation of an alternator. (7)

(b) A 60 – kVA, 220 V, 50 – Hz, 1 – phase alternator has effective armature resistance of 0.016 ohm and an armature leakage reactance of 0.07 ohm. Compute the voltage induced in the armature when the alternator is delivering rated current at a load power factor of (i) unity (ii) 0.7 lagging and (iii) 0.7 leading. (7)

8. (a) Discuss the effect of changing excitation on constant load synchronous motor. (7)

(b) Compare Synchronous and induction motor. (7)
