INDIAN MARITIME UNIVERSITY
DEPARTMENT OF MARINE ENGINEERING
TERM – END EXAMINATION – JUN / JUL 2011

Sub Code: UG/ME/BS/T/224 — Time: 0300 Hrs
Sub Name: ELECTRICAL MACHINES – II — Max. Marks: 100
Semester: IV — Pass Marks: 50

Part A (3 × 10 = 30 Marks)
Answer all the Questions

1. (a) Explain why an induction motor is called a "Generalized Transformer"?
   (b) Why an induction motor cannot run at synchronous speed?
   (c) Why the rotor slots are skewed?
   (d) What are the information needed to draw a circle diagram of 3 – phase induction motor?
   (e) A properly shunted centre – zero galvanometer is connected in the rotor circuit of a 6 – pole, 50 Hz wound – rotor induction motor. If the galvanometer makes 90 complete oscillations in one minute, calculate the rotor speed.
   (f) How do you operate the synchronous motor at any desired power factor?
   (g) What is a synchronous capacitance?
   (h) Enlist the advantage of using rotating field system
   (i) In an alternator, explain why short – circuit characteristic is a straight line where as open – circuit characteristic is a curve.
   (j) Discuss the difference between alternator and synchronous motor.

Part B (14 × 5 = 70 Marks)
Answer any five from the following

2. (a) Give the constructional details of three – phase induction motor, with neat sketch. Explain the functions of each part. (14)

3. (a) Explain the torque – speed curve of three – phase induction machine (7)
   (b) How to reverse the rotor direction in three – phase induction motor. (2)
   (c) A three – phase, 400/200 volts and star – star connected wound – rotor induction motor has 0.06 ohms rotor resistance and 0.3 ohms standstill reactance per phase. Find the additional resistance required in the rotor circuit to make the starting torque equal to the maximum torque of the motor. (5)

4. (a) Draw a neat diagram showing the connections of a 3 – phase induction motor with star – delta starter. Explain how the above starter reduces the starting current. (5)

(b) A 400 volts, 50 Hz, 6 – pole star connected 3 – phase induction motor is tested to yield the following results: (9)

No – load Test	400 V, 20 A, 2080 Watt (Line Values)
Block Rotor Test	133 V, 100 A, 8085 Watt (Line Vaules)

5. (a) Derive the expression for induced emf per phase in alternator. (7)

(b) Find the no – load phase and line voltage of a star connected three – phase, 6 – pole alternator which runs at 1200 rpm, having flux per pole of 0.1 weber, sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by 1 slot. (7)

6. (a) Show how a rotating magnetic field is produced having two poles for current distributions in the 3 – phase winding in an armature of a synchronous machine. (7)

(b) From the equivalent circuit of a 3 – phase cylindrical rotor synchronous generator derive an expression for its power input, power output and voltage regulations. (7)

7. (a) Calculate the values of resistance elements of a 4 – step starter for a 3 – phase, 400 volts, wound rotor induction motor. The full – load slip is 3 % and the maximum starting current is limited to its full load value. Rotor resistance per phase is 0.015 ohms. (7)

(b) Explain the operation of salient pole synchronous machine. (7)

8. (a) Explain from physical considerations, how a synchronous motor can be made to operate at leading or lagging power factors. Verify the above conclusions with suitable phasor diagrams. (7)

(b) A 480 V, 50 Hz, Y-connected, 6-pole synchronous generator has a per-phase synchronous reactance of 1 ohm. Its full load armature current is 60 amperes at 0.8 power factor lagging. This generator has friction and windage losses of 1.5 kilowatts and core losses of 1 kilowatts at 50 Hz full load. Since the armature resistance is being ignored, assume that the I^2R losses are negligible. The field current has been adjusted so that the terminal voltage is 480 volts at no-load. Calculate: (i) The speed of rotation of this generator. (ii) The terminal voltage of this generator if it is loaded with the rated current at 0.8 pf lagging. (iii) The voltage regulation of this generator at 0.8 pf lagging. (7)