INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

End Semester Examinations- June-July 2019

Semester – IV

B.Tech (Marine Engineering)

ELECTRICAL MACHINES II (UG11T2404)

Date: 01-07-2019 Maximum Marks: 100

Time: 3 Hrs Pass Marks: 50

Part-A

(Question 1 is Compulsory, 3x10 = 30 Marks)

Q1. a) Explain why an induction motor is called a "Generalized transformer. 3

b) What are the applications of three-phase squirrel cage and slip ring induction motors? 3

c) What are the different types of starters used for induction motors? 3

d) A 4-pole induction motor is fed from 50-Hz supply. If the frequency of rotor emf at full-load is 2-Hz, find the full-load speed. 3

e) Why an induction motor cannot run at synchronous speed? 3

f) What is a fractional pitch winding? 3

g) What is meant by synchronous reactance of alternators? 3

h) What is meant by *V*-curves of a synchronous motor? 3

i)A 600V, 60kVA, single phase alternator has an effective resistance of 0.2 ohm. A field current of 10A produces an armature current of 210A on short-circuit and an emf of 480V on open-circuit, find the synchronous impedance and reactance. 3

j) What is synchronous condenser? 3

Part-B

(Answer any 5 questions from question nos. 2 to 8)

(5X14 =70 Marks)

Q2. a) Draw the neat sketch of stator and rotor laminations of an Induction motor. State the functions of each part. 7 Marks

b) Show that in an induction motor, ("Rotor input **:** power developed **:** rotor copper losses) **=** (1 **:** (1-S) **:** S"), where S is the fractional slip.

7 Marks

Q3. a) If stator impedance of an induction motor is neglected, then show that $\frac{T_e}{T_{\max}} = \frac{2}{\frac{s_{mt}}{s} + \frac{s}{s_{mt}}}$. Where, $T_{\max}$ is maximum torque and S_{mt} is the slip at maximum torque. 7 Marks

b) A 3-phase star connected 6.6 kV, 20 pole, 50 Hz induction motor has rotor resistance of 0.12 ohm and stand still reactance of 1.12 ohm. The motor has speed of 291rpm at full load. Calculate slip at maximum torque and ratio of maximum torque to full load torque. (neglected stator resistance and reactance). 7 Marks

Q4. a) Explain with neat diagram of Auto-transformer starting of 3-phase induction motor. 7 Marks

b) Design the sections of a rotor starter for a 75kW, 3-phase induction motor, using 7 notches. Rotor resistance per phase is 0.018 ohm. The upper current limit is to be full-load current for which slip is 2%. 7 Marks

Q5. a) Classifies the single-phase induction motors. Write down the working principle of a single phase motor. 7 Marks

b) A 400 V, 50 Hz, 6-pole star connected 3-phase induction motor is tested to yield the following results:

No-load test : 400 V, 20 A, 2080 watt (line values).

Block rotor tests: 133 V, 100 A, 8085 watt (line values).

The stator winding resistance per phase is 0.15 ohm. Determine the equivalent circuit parameters of the motor. 7 Marks

Q6. a)Derive an expression for winding distribution factor of a 3-phase Synchronous Generator. 7 Marks

b)Derive an expression for emf generated per phase in 3-phase synchronous generator. 7 Marks

Q7. a) Explain briefly "hunting of synchronous machines. 7 Marks

b) A 3-phase, 50 Hz, 415 V, synchronous machine operates at rated voltage and at a leading pf of 0.9. Shaft power is 15 kW and the excitation emf is 400 V. If per-phase resistance is 0.5 ohm, find the synchronous reactance, neglect mechanical losses of the system.

7 Marks

Q8. a) Discuss about the conditions necessary for paralleling of two three phase alternators. 7 Marks

b) A 220 V, 3-phase star-connected synchronous motor has a resistance of 0.22 ohm/phase and a synchronous reactance of 2.4 ohm/phase. The motor is operating at 0.6 power factor leading with a line current of 180 A. If the stray losses of the machine are 3200 W, Find (i) EMF induced (ii) Output power and (iii) Efficiency of the machine.

7 Marks