

# INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

## END SEMESTER EXAMINATION December 2017

**Programme:** B.Tech (Marine Engineering)

**Semester:** IV

**Subject Name:** Electrical Machines-II

**Subject Code:** UG11T2404/  
UG11T1404

**Date:** 02.01.2018

**Maximum Marks:** 100

**Time:** 10 am to 1pm

**Pass Marks:**50

### PART – A

Marks:10X3=30

(All questions are compulsory)

1. (a) 4pole, 50hz, 7.46kw, motor has, at rated voltage and frequency, starting torque is 160% and maximum torque 200% of full load torque. Find speed at full load and at maximum torque. (3)
- (b) Draw neat diagram of star-delta starter used for induction motor. What is open transition w.r.t. the same? (3)
- (c) Find phase and line emf of star connected 3 phase, 6 pole alternator which runs at 1200rpm, having flux per pole of 0.1 wb. Its stator has 54 slots and each slot carries 8 conductors and coil is chorded by 1 slot. (3)
- (d) Machine A has 60 deg phase spread and machine B has 120 deg phase spread. Both machines have uniformly distributed winding. Find the ratio of distribution factors of machine A to machine B. (3)
- (e) Show effect of excitation ( $I_f$ ) on PF and  $I_a$  of synchronous motor with the help of V and inv. V curves for different load conditions. (3)
- (f) Draw block schematic of brush-less excitation system of alternators and state advantages of it over other systems. (3)
- (g) Draw neat diagrams with proper labelling for split phase and capacitor start type 1-phase induction motors (3)
- (h) 12 pole, 3 phase alternator driven at a speed of 600 rpm supplies power to an 8 pole, 3 phase induction motor. If the slip of the motor, at full load is 3 %, calculate full load speed of motor. (3)
- (i) Centre-zero galvanometer is connected in rotor circuit of 4 pole, on-board ship applied wound rotor induction motor. If galvanometer makes 72 complete oscillations in one minute, calculate rotor speed. (3)
- (j) Explain in brief starting methods of synchronous motor. (3)

**PART – B**

Marks:5X14=70

(Answer any 5 of the following)

2. 3 phase, 4 pole, 1440rpm, 50 Hz, induction motor has star connected rotor winding, having a resistance of 0.2ohm per phase and a standstill reactance of 1ohm per phase. When the stator is energized at rated voltage and frequency, the rotor induced emf at standstill is 120v per phase.

a) Calculate rotor current, rotor power factor and torque at starting and at full load. (6)

b) if an external resistance of 1ohm per phase is inserted in rotor circuit, calculate rotor current, rotor power factor and torque at starting. (6)

c) Conclude with the effect of adding external resistance comparing results at starting. (2)

3. 10kw, 400v, 3 phase, 4 pole, 50 hz, slip ring induction motor develops rated output at rated voltage and frequency and with its slip rings short circuited. The maximum torque equal to twice the full load torque occurs at a slip of 10% with zero external resistance in the rotor circuit. Stator resistance and rotational loss are neglected. Determine: i) slip and rotor speed at full load torque, ii) rotor ohmic loss at full load torque, iii) starting torque at rated voltage and frequency, iv) full load efficiency (14)

4. a) 400v, 50hz, 6 pole, delta, 3 phase, squirrel cage induction motor consumes 45kw with line current of 75amp and runs at slip of 3%. if stator iron loss is 1.2kw, windage & friction loss is 0.9kw and resistance between two stator terminals is 0.12ohm, calculate efficiency and shaft torque. (7)

b) An induction motor has an efficiency of 0.9 when the shaft load is 45 kw. At this load, stator ohmic loss and rotor ohmic loss each is equal to the iron loss. The mechanical loss is one third of the no load losses. Neglect ohmic losses at no load. Calculate the slip. (7)

5. Draw neat diagram and label parts of following starters of 3 phase induction motor: (14)

a) DOL starter, b) auto transformer starter, c) rotor resistance starter

6. a) Describe speed control methods of 3 phase induction motor. (7)

b) Differentiate between induction and synchronous motor. (7)

7. a) What is necessity of parallel operation of two alternators? (4)

b) What are conditions for parallel operation of two alternators? (4)

c) Write principle of operation of induction motor. (4)

d) Define synchronous speed and slip for induction motor. (2)

8. 15 kw, 231v, 4 pole, 60hz, 3 phase delta connected induction motor gave following results:

	No Load Test	Blocked Rotor Test
Line Voltage	231v	115.5v
Line Current	15.6amp	86.6amp
Power factor	0.21	0.41

The effective per phase stator resistance is 0.45 ohm and per phase rotor resistance referred to stator is 0.15 ohm

Take current scale as 6 amp=1 cm.

a) Draw circle diagram from above information. Details of calculations, neatness, retention of geometrical constructions and proper labelling is of utmost importance. (7)

b) Find power scale. Locate half load operating point on circle diagram and also find line current, p.f. at this operation from circle diagram. (7)

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