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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: EE202

Course Name: SYNCHRONOUS AND INDUCTION MACHINES (EE)

Max. Marks: 100 ***Graph sheets shall be provided.*** Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1 Derive the emf equation of an alternator. (5)

2 Draw the phasor diagram of a cylindrical rotor type alternator with a) unity power factor load and (b) leading power factor load (5)

3 Write the necessary conditions for synchronization of alternators. (5)

4 Synchronous motor is not self starting. Why? (5)

5 What is crawling in induction motor? How it can be eliminated? (5)

6 Explain V/f speed control method in 3 phase induction motor. (5)

7 Explain the working principle of synchronous induction motor? (5)

8 Why single-phase induction motor is not self-starting? Also draw its torque - slip curve? (5)

PART B

Answer any two full questions, each carries 10 marks.

9 a) Compare salient pole alternator with smooth cylindrical alternator? (4)

b) A 3-phase, 8 pole, 750rpm, star connected alternator has 72 slots on armature. Each slot has 12 conductors and winding is short pitched by two slots. Find the induced emf between the lines , given flux per pole 0.06 Wb. (6)

10 Following test results are obtained on a 6600V alternator (10)

Open circuit voltage in volts	3100	4900	6600	7500	8300
Field currents in Amperes	16	25	37.5	50	70

A field current of 20A is found to circulate full load current on armature with short circuited. Calculate full load regulation at 0.8 pf lag by using mmf method. Neglect armature resistance.

11 a) Explain the causes of harmonics in alternators? How it can be eliminated? (5)

b) A 3-phase star connected alternator supplies a load of 1000kW at a pf of 0.8 lagging with a terminal voltage of 11kV. Its armature resistance is 0.4Ω per phase while synchronous reactance is 3Ω per phase. Calculate the line value of emf induced and full load regulation. (5)

PART C

Answer any twofull questions, each carries 10 marks.

12 a) Explain the procedure to conduct slip test with a neat circuit diagram (5)

b) Explain synchronisation of alternators using dark lamp method. (5)

13 a) Explain any one method of starting of synchronous motor. (4)

b) A 2000V, 3-phase, 4 pole star connected synchronous motor runs at 1500 rpm. The excitation is constant and corresponds to an open circuit voltage of 2000V. The resistance is negligible compared to synchronous reactance of 3Ω per phase. Determine power input, power factor, torque developed for an armature current of 200A (6)

14 a) Explain the effect of change in excitation of an alternator? (5)

b) A 400V, 4-pole, 3-phase, 50Hz, star connected induction motor has rotor resistance and reactance per phase 0.01Ω and 0.1Ω respectively. Determine a) starting torque b) slip at maximum torque and c) maximum torque. Given rotor to stator turns is 0.25. (5)

PART D

Answer any twofull questions, each carries 10 marks.

15 Draw the circle diagram of a 20 Hp, 400 V, 50 Hz, 3-phase, star-connected induction motor from the following test data (line values) (10)

No load Test : 400V, 9 A , 0.2 pf

Blocked Rotor Test : 200V, 50 A, 0.4 pf

From the circle diagram, find the line current and power factor at full load.

The stator and rotor copper losses are divided equally in the blocked rotor test.

16 a) Explain with neat diagram, star-delta starter in 3-phase induction motor. (5)

b) Compare induction generator with synchronous generator. (5)

17 a) Explain types of single-phase induction motors with relevant figures? (8)

b) Draw the equivalent circuit of single-phase induction motor (2)

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