Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EE202

Course Name: SYNCHRONOUS AND INDUCTION MACHINES (EE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

(Graph sheets may be supplied)

1 Compare salient pole & cylindrical rotor type of alternators. (5)

2 What is armature reaction? Explain the effects of armature reaction in an alternator. (5)

3 Draw the phasor diagram of a salient pole alternator working at a lagging power factor and derive an expression for the regulation. (5)

4 Sketch and explain the V and inverted V- curves of a synchronous motor. (5)

5 What is the need for starter in a 3-Φ induction motor? Explain the principle of operation of a star – delta starter. (5)

6 Sketch the equivalent circuit of a double cage induction motor and explain the parameters. (5)

7 Explain the principle of operation of synchronous induction motor. What are its advantages over synchronous motors? (5)

8 Why is a 1-Φ induction motor not self starting? How is it made self starting? (5)

PART B

Answer any twofull questions, each carries 10 marks.

9 a) Define pitch factor and distribution factor as related to an ac winding. Derive expressions for both. (4)

b) A 3-Φ, 10 pole alternator has 2 slots/ pole/ phase on its stator with 10 conductors per slot. The air gap flux is sinusoidally distributed and equals 0.05 Wb. The stator has a double layer winding with a coil span of 150^{o}E. If the alternator is running at 600 rpm, calculate the emf generated /phase at no load. (6)

10 a) The following data pertains to a 5000kVA, 6600 V, 3-Φ, 50 Hz star connected alternator. (10)

Field current	32	50	75	100	140
OC voltage	3100	4900	6600	7500	8300
ZPF voltage (line) (full load)	0	1850	4250	5800	7000

Determine the regulation by ZPF method at full load unity power factor. Neglect

armature resistance. Draw its phasor diagram also.

11 a) How do harmonics affect the emf generated in an alternator? What are the techniques used to minimise these harmonic voltages in the induced emf? (4)

b) A 3-Φ, 10 kVA, 400 V, 50 Hz, star connected alternator supplies the rated load at 0.8 pf lag. If the armature resistance is 0.5Ω and synchronous reactance is 10Ω, find the load angle and voltage regulation. (6)

PART C

Answer any twofull questions, each carries 10 marks.

12 a) Explain the procedure for conduct of slip test using a neat circuit diagram. (4)

b) The efficiency of a 3-Φ, 400 V, star connected synchronous motor is 95 % and it takes 24A at full load, upf. What will be the induced emf and mechanical power developed at full load, 0.9 pf lead. The synchronous reactance is (0.2+ j2)Ω. (6)

13 a) Describe with the help of a neat circuit diagram, the two bright and one dark lamp method of synchronising an alternator to the AC mains. (4)

b) A 6-pole, 50 Hz,3-Φ induction motor running on full load develops a useful torque of 150 Nm at a rotor frequency of 1.5 Hz. Calculate the shaft power output. If the mechanical torque lost in friction is 10 Nm, determine a) rotor copper loss b) input to the motor c) the efficiency. The total stator loss is 700 W. (6)

14 a) Describe a set of torque slip characteristics of a 3-Φ induction motor. Explain the effect of change in rotor resistance on the characteristics. (4)

b) Two 3-Φ, 6.6 kV star connected alternators supply a load of 3000kW at 0.8 pf lag. The synchronous impedance/phase of machine A is 0.5 + j 10 Ω and that of machine B is 0.4 +j12 Ω. The excitation of machine A is adjusted so that it delivers 150 A at a lagging power factor and the governors are so set that the load is equally shared between the machines. Determine the current, power factor and induced emf of each machine. (6)

PART D

Answer any two full questions, each carries 10 marks.

15 a) What is "Crawling" in induction motors? What are its causes and how can it be eliminated? (5)

b) Draw the equivalent circuit of a 1-Φ induction motor and explain how it is used to predetermine the performance of the machine. (5)

16 a) A 3-Φ, 400 V, 14.91 kW induction motor gave the following test results. (6)

NL test : 400 V, 1250 W, 9A.

BR test : 150 V, 4000 W, 38 A.

Draw the circle diagram and determine the full load current, power factor, slip and efficiency.

b) With a neat diagram, explain the capacitor start and run type of induction motor. (4)

17 a) Describe the principle of operation of an induction generator. Compare grid connected and self excited type of induction generators. (5)

b) Describe any two methods of speed control of a 3-Φ induction motor. (5)

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