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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017**

**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.*

- 1 Enumerate various methods for minimising harmonics in alternators. (5)
- 2 What are the different methods of finding the voltage regulation of an alternator. (5)
- 3 Describe the slip test method for finding the  $X_d$  and  $X_q$  of synchronous machines. (5)
- 4 Explain the constructional details of a synchronous motor. (5)
- 5 Differentiate between the phenomenon cogging and crawling of an induction motor. (5)
- 6 List the various methods adopted for braking of an induction motor. (5)
- 7 Compare induction generator with synchronous generator. (5)
- 8 With a sketch describe the principle of working of a shaded pole motor. (5)

**PART B***Answer any two questions. Each carries 10 marks.*

- 9 a) Explain various types of armature winding of an alternator. (5)
- b) Find the distribution and pitch factor of a  $3\Phi$ , 4 pole, 24 slots alternator having its armature coils short pitched by one slot. (5)
- 10 A 0.5 MVA, 1.1KV, 50 Hz,  $3\Phi$ , star connected alternator has  $R_a$  and  $X_s$  per phase as  $0.1\Omega$  and  $1.5\Omega$  respectively. Find its voltage regulation at different power factor of (i) unity (ii) 0.9 lag and (iii) 0.8 lead at full load. (10)
- 11 A 220V, 6 pole, 50 Hz. star connected alternator gave the following test results: - (10)

Field current in A	0.2	0.4	0.6	0.8	1	1.2	1.4	1.8	2.2	2.6	3	3.4
Open circuit line voltage in Volts	29	58	87	116	146	172	194	232	261	284	300	310
ZPF test line voltage in volts	-	-	-	-	-	0	29	88	140	177	208	230
SCC in A	6.6	13.2	20	26.5	32.4	40	46.3	59				

Find % voltage regulation at full load current of 40A at power factor 0.8 lag by  
 (i) m.m.f method (ii) ZPF method.  $R_a = 0.06 \Omega$  /phase.

**PART C***Answer any two questions. Each carries 10 marks.*

- 12 Explain the two reaction theory of salient pole alternator. (10)
- 13 a) Describe the constructional features of 3 $\Phi$  slip ring induction motor. (5)
- b) A 6 pole, 50 Hz, 3 $\Phi$ , slip ring induction motor, the rotor resistance and the reactance at stand still per phase are 0.3 and 1.5  $\Omega$  respectively. The e.m.f between the slip rings on open circuit is 175V. Calculate (i) Slip (ii) rotor e.m.f/phase (iii) rotor frequency and reactance when the motor runs at a speed of 950 r.p.m. (5)
- 14 a) What are the various methods of synchronisation of alternators. (5)
- b) Explain the effect of excitation on armature current and power factor of a synchronous motor and hence deduce the V and inverted V curves. (5)

**PART D***Answer any two questions. Each carries 10 marks.*

- 15 a) What are the different types of starters used for starting a 3 $\Phi$  induction motor. (5)
- b) A 3 $\Phi$  induction motor has a short circuit current 5 times of full load current at 5% slip. Determine the starting torque and starting current if the impressed voltage is reduced to 60% of the normal voltage by using starting resistance starter. The full load current and torque are 10 A and 10 Nm respectively. (5)
- 16 a) Explain the principle of operation of an induction generator. (10)
- b) Describe the double field revolving theory of a 1  $\Phi$  induction motor. (5)
- 17 a) Draw the circle diagram of a 3 $\Phi$ , 20 hp, 400V, 50Hz star connected induction motor with the following test data: - (5)
- |                  |      |     |                 |
|------------------|------|-----|-----------------|
| No load test     | 400V | 9A  | $\cos \Phi=0.2$ |
| block rotor test | 200V | 50A | $\cos \Phi=0.4$ |
- Stator and rotor copper losses are divided equally in the block rotor test.
- b) From the above circle diagram obtain (a) line current (b) power factor (c) slip (d) efficiency at full load. (5)

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