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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   (5)
     motor.

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 3Φ, 4 pole, 24 slots alternator having its   (5)
          armature coils short pitched by one slot.

10   A 0.5 MVA, 1.1KV, 50 Hz, 3Φ, star connected alternator has R_a and X_s per phase   (10)
     as 0.1Ω and 1.5Ω respectively. Find its voltage regulation at different power factor
     of   (i) unity   (ii) 0.9 lag and   (iii) 0.8 lead at full load.

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 Ω /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 3Φ slip ring induction motor.   (5)

    b) A 6 pole, 50 Hz, 3Φ, slip ring induction motor, the rotor resistance and the reactance   (5)
       at stand still per phase are 0.3 and 1.5 Ω 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.

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   (5)
       synchronous motor and hence deduce the V and inverted V curves.

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

15 a) What are the different types of starters used for starting a 3Φ induction motor.   (5)

    b) A 3Φ induction motor has a short circuit current 5 times of full load current at 5%   (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.

16 a) Explain the principle of operation of an induction generator.   (10)

    b) Describe the double field revolving theory of a 1 Φ induction motor.   (5)

17 a) Draw the circle diagram of a 3Φ, 20 hp,400V,50Hz star connected induction motor   (5)
       with the following test data: -
           No load test   400V   9A   cos Φ=0.2
           block rotor test   200V   50A   cos Φ=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)   (5)
       efficiency at full load.

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