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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S,FE) (FT/WP), (S3 PT) Examination May 2025 (2019 Scheme)

Course Code: EET307

Course Name: SYNCHRONUS AND INDUCTION MACHINES

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1	In a 4 pole three phase alternator , armature has 36 slots .It is using an armature winding which is short pitched by one slot. Calculate winding factor.	3
2	Draw and discuss phasor diagram of synchronous generator at Unity power factor condition and under leading power factor condition .	3
3	Xad is greater than Xaq in salient pole alternator .Justify	3
4	Enumerate the conditions for synchronising two alternators.	3
5	Draw power flow diagram of synchronous motor.	3
6	Compare squirrel cage and slip ring induction motors.	3
7	Explain how high starting torque is achieved in double cage induction motor.	3
8	Explain any one method for speed control of a three phase induction motor	3
9	Sketch torque -slip curve of single phase induction motor.	3
10	Explain why single phase induction motor is not self starting.	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11 a) Develop an expression for EMF equation of alternator. 4

b) Explain armature reaction in alternator with neat sketches when it is operating at (i) lagging pf. (ii) Unity pf (iii) Leading pf. 10

12 a) What are the advantages of using stationary armature over rotating armature in an alternator 6

b) A star connected 3 phase,6 pole alternator having flux per pole of 0.1 Wb runs at 1200 rpm. It has 54 slots and each coil has 8 turns. Find the generated EMF when i) the winding is full pitched and ii) the winding is short pitched by 1 slot 8

Module -2

13 a) Explain method of synchronization of alternators by using dark lamp method. 7

b) A 3 phase 1000kVA ,2500V ,50Hz star connected alternator gives a short circuit current of 400A for a certain excitation .With the same excitation the open circuit voltage was 2300V .The armature resistance is 0.309 Ohm .Find full load voltage regulation at 0.8 pf lagging and at UPF. 7

14 A 10kVA, 400 V, 50 Hz, 3 phase, star connected, alternator has the open circuit characteristics as below 14

I_f (A)	1	2	3	4	5	8	11	15
V_{oc} (L-L)	100	190	300	380	440	550	600	635

With full load zero power factor, the excitation required is 12 A to produce 400 volts terminal voltage. On short circuit 4 amperes excitation is required to produce full load current. Determine the full load voltage regulation at 0.8 pf lagging by ZPF Method.

Module -3

15 a) Draw and explain V curve and inverted V curve of a synchronous motor. 7

b) A three phase 10hp ,230V , star connected synchronous motor delivers full load at a pf of 0.707 leading. The synchronous reactance of motor is 5 Ohm per phase. The mechanical loss is 300W . Calculate the efficiency of the motor and generated voltage of the motor. Assume armature resistance as zero. 7

16 a) Synchronous motor is not self starting. How can it be started ? Explain with one method. 7

b) The stator resistance of a 400 V , 40 hp , 50 Hz 3 phase induction motor is 0.015 Ohm per phase and gave the following test data: No load test: 400 V , 20 A , 1.2kW . Blocked rotor test: 100 V , 45 A , 2.75kW. Calculate equivalent circuit parameters of the motor. 7

Module -4

17 A 20hp. 4 pole. 50Hz. 400V, three phase star connected Induction motor gave the following test results: 14
No load test: 400V, 9A, 1250W
Blocked rotor test: 200V, 50A, 7500W
Draw the circle diagram and find the input line current .input power factor. maximum output power and stator Cu loss at stand still. Assume rotor Cu loss at standstill is equal to stator Cu loss.

18 a) Describe working of DOL (Direct On Line) starter for an induction motor. 7

b) A 3hp ,3 phase induction motor with full load efficiency and power factor of 0.83 and 0.8 respectively has short circuit current of 3.5 times the full load current . Calculate the starting current of the motor when 500V is given to motor by means of star delta starter. Ignore magnetising current. 7

Module -5

19 a) Explain classification of induction generator based on modes of operation with neat sketches. 10

b) List the applications of single phase induction motors 4

20 a) Explain working of Split phase type,Capacitor start and Capacitor start and run type single phase induction motors with neat sketches. 10

b) What are the factors for selecting AC motor for various applications? 4

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