Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S5 (S, FE) / S3 (PT) (S) Examination June 2024 (2019 Scheme)

Course Code: EET 307
Course Name: SYNCHRONUS AND INDUCTION MACHINES

Max. Marks: 100   Duration: 3 Hours

PART A
(Answer all questions; each question carries 3 marks)

Marks

1	Compare Salient pole and Non-Salient pole synchronous machines.	3
2	An 8-pole ac generator is running at 750 rpm. What is the frequency? At what speed must the generator run so that the frequency shall be 25 Hz.	3
3	What is short circuit ratio? Show that SCR is reciprocal of synchronous impedance.	3
4	What are X_d and X_q?	3
5	Explain the functions of a damper winding in a synchronous motor.	3
6	Draw the Torque-Slip characteristic of a 3-phase induction motor and clearly indicate the effect of change in rotor resistance.	3
7	Explain the phenomenon of cogging and crawling in squirrel cage induction motor.	3
8	What is the condition for maximum torque at starting in a 3-phase induction motor.	3
9	Differentiate between synchronous generator and induction generator.	3
10	What is double field revolving theory.	3

PART B
(Answer one full question from each module, each question carries 14 marks)
Module -1

11   a)   What is Armature Reaction? Explain the effect of armature reaction on the terminal voltage of an alternator at   14

1)unity power factor load

2)leading power factor load

3)lagging power factor load. Draw the relevant phasor diagrams.

12   a)   A 16 pole 3 phase alternator has a star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03Wb. The winding is distributed and the speed is 375rpm.Find the line voltage, if the coil span is 150^0 electrical.   8

b) Derive from the first principles, the emf equation of a 3-phase synchronous machine. 6

Module -2

13 a) Discuss Blondel's two reaction theory applicable to salient pole synchronous machine. 8

b) What are the conditions to be fulfilled for parallel operation of two synchronous machines? Give any one method of synchronising. 6

14 a) Find the regulation by the zero-power factor method of 5000kVA ,6600V,3phase,50 Hz star connected alternator at full load, unity power factor having the following test data: 14

Field current in ampere	32	50	75	100	140
Open circuit terminal voltage in volts	3100	4900	6600	7500	8300
Full load current zero pf tests Line pd in volts	0	1850	4250	5800	7000

Module -3

15 a) Explain the effects of varying excitation on armature current and power factor in a synchronous motor. Draw V curve and Inverted V curve. 8

b) A 3-phase, 440V, 50Hz star connected synchronous motor takes 7.46kW from the 3-phase supply mains. The resistance per phase of the armature winding is 0.5. The motor operates at a pf of 0.75 lag. Iron & mechanical losses amount to 500W. The excitation loss is 650W. Assume the source for excitation to be a separate one. Calculate (i) armature current (ii) power supplied to motor (iii) efficiency. 6

16 a) A 400V, 3-phase delta connected induction motor gave the following test data 8
No load test: 400V   3A   645W
Blocked rotor test: 200V   12A   1660W
The friction & windage losses amount to 183W. Obtain the equivalent circuit diagram of the induction motor. Take stator winding resistance per phase = 5.

b) A 3-phase 6-pole, 50Hz induction motor develops 3.7kW at 950rpm. What is the stator input if the stator loss is 300W? 6

Module -4

17 a) Draw the circle diagram of a 5hp, 200V, 50Hz, 4 pole, 3-phase star connected induction motor from the following test data 14

No load test: 200V   5A   350W

Blocked rotor test: 100V   26A   1700W

From the circle diagram find full load current power factor, speed, and torque

18 a) Explain various methods of starting of a 3-phase induction motor.   8

b) Discuss any two methods of speed control of 3 phase squirrel cage induction   6
motors.

Module -5

19 a) Describe with a neat diagram the principle of operation of Induction Generator.   8

b) How can an Induction Generator feed power into a constant voltage constant   6
frequency bus? Draw the equivalent circuit of Induction generator.

20 a) Explain with neat diagrams the following types of single-phase induction motors.   14

a) Split phase induction motor

b) Capacitor start Induction run motor.

Also draw their torque -speed characteristic.

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