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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

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		Derive the expressions for 'Distribution factor' and prove that distribution factor approaches a constant value as number of slots/pole increases.	(5)
2		Explain the EMF method of determining voltage regulation of an alternator.	(5)
3		Explain the effects of change in excitation when two alternators are connected in parallel.	(5)
4		A 2 pole, 3-phase Induction motor runs at 2910 rpm on a 50Hz supply. Find (i) synchronous speed and (ii) frequency of rotor emf.	(5)
5		Describe the constructional feature of double cage induction motor to obtain large starting torque.	(5)
6		Explain how the shunt parameters of the equivalent circuit of a 3-phase Induction motor can be obtained from no-load test.	(5)
7		Explain the principle of operation of an Induction generator.	(5)
8		Explain the working of shaded pole motor.	(5)

PART B

Answer any two full questions, each carries 10 marks.

9	a)	Derive the expression for pitch factor. Also find the value of short pitching angle to eliminate fifth harmonics completely.	(6)
	b)	Derive the emf equation of an alternator. (Expressions for pitch and distribution factors need not be derived)	(4)
10		A 3-phase, 4-pole, star connected alternator has a smooth cylindrical type rotor. The effective resistance and synchronous reactance per phase are 0.15Ω and 2.5Ω respectively. Calculate the voltage regulation when delivering 250 A at 6.6 kV at different power factors of (i) 0.6 pf lagging. (ii) upf (iii)0.8 pf leading.	(10)

11 a) A 3-phase, 4 pole, 50 Hz, synchronous generator has 48 slots in which double layer winding is housed. Each coil has 10 turns short pitched by an angle of 36^0 electrical. Flux/pole is 0.025 Wb (sinusoidally distributed). Then, for a 3phase, Y connection, find (i) the line to line induced emf (ii) the fifth harmonic component of line to line induced emf. (6)

b) List the effects of armature reaction in a synchronous generator at upf, zero pf lag and zero pf lead? (4)

PART C

Answer any two full questions, each carries 10 marks.

12 Describe the synchronising procedure using dark lamp and bright lamp methods. (10)

13 a) Explain clearly how a rotating magnetic field is setup around the stator of a 3-phase Induction motor when a 3-phase supply is fed to it. (6)

b) Define slip related to an Induction motor. What is the expression for slip? (4)

14 a) Draw the phasor diagram of a salient pole alternator supplying a current which leads line voltage V and lags the generated voltage E. (5)

b) Draw and explain the V-curve and Inverted V-curve of a synchronous motor (5)

PART D

Answer any two full questions, each carries 10 marks.

15 A 4 pole, 50Hz, 415V, 37kW, delta connected , 3-phase Induction motor gave the following test results: (10)
No load test: 415V, 16A, 1.75kW
Blocked rotor test: 100V, 55A, 1.85kW
Draw the circle diagram and find the input line current and input power factor at full load. Assume rotor Cu loss at standstill is equal to half of total Cu loss.

16 Describe the following single phase Induction motors: (i) Capacitor start type and (ii) split phase type with torque-speed characteristics and phasor diagram (10)

17 a) Find the line current drawn from the supply when a 3-phase Induction motor is started using (i) a star-delta starter, (ii) Auto transformer of ratio 0.5, if the line current drawn from the supply is 6A without any starter. (5)

b) Explain the double revolving field theory related to single phase Induction motor. (5)

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