

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° 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 C_u loss at standstill is equal to half of total C_u 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)
