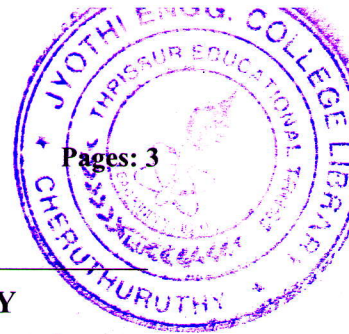


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Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree (S,FE) Examination August 2021 (2015 Scheme)

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 (2nos per student) may be supplied

- 1 Compare the constructional features of salient pole and cylindrical rotor type synchronous generators. (5)
- 2 Describe the effect of armature reaction in synchronous generators at zero pf lag. (5)
- 3 Draw the phasor diagram of a salient pole synchronous generator at upf. (5)
- 4 Explain any two methods of starting of 3-phase synchronous motor. (5)
- 5 Draw the equivalent circuit of a 3-ph. induction motor and mark all parameters. (5)
- 6 Explain stator voltage control of 3-phase induction motor with torque-speed (or slip) characteristics. (5)
- 7 Describe the principle of operation of a self-excited 3-phase induction generator. (5)
- 8 Explain the working of a 1-phase capacitor-start induction motor with necessary phasor diagram. (5)

PART B

Answer any twofull questions, each carries 10 marks.

- 9 a) Derive the expression for distribution factor in an alternator. (5)
b) The phase of emf of a 3-phase 50Hz alternator consists of a fundamental, a 20% third harmonic and a 10% fifth harmonic. The amplitude of the fundamental is 1000V. Calculate the rms line voltage when the windings are connected in star. (5)
- 10 For a 3-phase, 5000kVA, 6600V, 50Hz, star-connected alternator, find the voltage regulation at full-load and unity power factor using Potier method. The OC, ZPFC test data are shown below. Neglect armature resistance. (10)

Field current (amp)	32	50	75	100	140
Open circuit voltage (line) (volt)	3100	4900	6600	7500	8300
Full load voltage at zero p.f. lag (line) (volt)	0	1850	4250	5800	7000

- 11 a) List 3 methods for suppression of harmonics in generated emf of an alternator. (5)
 b) Describe synchronous impedance method for determination of voltage regulation. (5)

PART C

Answer any two full questions, each carries 10 marks.

- 12 a) Explain the effect of change of excitation in a synchronous generator connected to infinite busbar. Also, draw the V-curves and inverted V-curves marking the regions of lagging and leading power factors. (5)
 b) Describe the method to determine direct-axis and quadrature axis synchronous reactances of a salient-pole synchronous machine. (5)
- 13 a) Draw the phasor diagram of a cylindrical-rotor type synchronous motor at i) unity power factor ii) lagging power factor and iii) leading power factor taking excitation emf E_f as reference. (6)
 b) In a 6 pole, 3 phase, 50Hz induction motor with star-connected rotor, the rotor resistance per phase is 0.3Ω , the reactance at standstill is 1.5Ω per phase and an emf between the slip rings on open circuit is 175V. For a speed of 950 rpm, calculate i) slip ii) rotor emf per phase iii) rotor frequency and reactance. (4)
- 14 a) Describe the dark-lamp method for synchronising an alternator with infinite bus (5)
 b) Derive the expression for torque equation in a 3-phase induction motor. (5)

PART D

Answer any two full questions, each carries 10 marks.

- 15 For a 3-phase, 20HP, 400V, 4-pole, 50Hz star-connected induction motor, draw the circle diagram and hence find i) line current and power factor at full load and ii) maximum power output. (10)

No Load Test (line values) : 400V 9A p.f. = 0.2

Blocked Rotor Test (line values) : 200V 50A p.f. = 0.4

The stator and rotor copper losses are divided equally in the blocked rotor test.

Take current scale = 5A/cm. Use graph sheet.

- 16 a) Describe the working of a synchronous induction motor with necessary diagram. (5)
- b) Describe double revolving field theory in single-phase induction motors. (5)
- 17 a) Compare induction generator and synchronous generator. (5)
- b) Determine approximately the starting torque of a 3-phase induction motor in terms of full-load torque when started by i) star-delta starter ii) an auto-transformer starter with 50% tapping. The short-circuit current of motor is 5 times the full-load current and the full-load slip is 5%.
