Elect

College of Engineering, Pune

End Semester Exam – November 2012

T . Y. B. Tech. (Electrical)

(EE 351)- (Electrical Machines II)

Day & Date- Wednesday , 28th November 2012.

Maximum Marks: 50 Duration – 3hrs.

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Assume suitable data, if necessary and state clearly the same.
4. Use of Programmable pocket electronic calculators use is allowed.

			Marks
Q1	**A**	A 3-phase, 50 Hz induction motor is running at a speed of 728 rpm. Determine the number of poles, frequency of rotor emf and speed of rotor mmf in radians/sec relative to stator.	5
	B	A 22.5kW, 500V, 4 pole, 50 Hz, delta connected squirrel cage induction motor has following data :- $r_1 = r_2'$ No load test : 500V, 8.3A, 1.5kW. s.c test : 100V, 32A, 1.6kW. Draw the circle diagram from which obtain the following for full load conditions :- (i) Line current; (ii) Power factor; and (iii) Efficiency. Determine the maximum torque developed by the motor in N-m.	5
Q2	**A**	State the different methods of speed control of 3-phase induction motor. Explain the method using emf injection in the rotor circuit of the motor. State clearly the assumptions made and draw the phasor diagram.	5
	B	The normal full load slip and shaft torque of a 375kW, 50Hz, 3 phase induction motor are 1.9% and 9450 N-m respectively. The standstill value of rotor impedance is (0.25 + j1.5)Ω/ph. Estimate the speed and power output for full load stator current when a resistor of 2Ω/ph is inserted in the rotor circuit.	5
Q3	**A**	Derive an expression for the power output of a 3-phase, salient pole generator in terms of excitation emf/ph, terminal voltage, x_d , x_q and δ. Draw the phasor diagram and P-δ characteristic for a $\frac{x_q}{x_d}$ ratio of 0.7.	4

B A salient pole synchronous motor has x_d = 0.8pu and x_q= 0.5 pu. It is running from an infinite bus of V_∞= 1 pu. Neglect all losses. What is the minimum p.u. excitation for which the machine will stay in synchronism with full load torque? 3

C A round rotor synchronous generator has L_{aa} = 2.65mH and L_{al} = 0.255mH. Calculate the mutual inductance between any two phases and the machine synchronous reactance at 50Hz. 3

Q4 A A 20MVA, 11kV, 3-phase, delta connected synchronous motor has a synchronous reactance of 15 Ω/phase and armature resistance is negligible. Windage, friction and iron losses total to 1200kW. Determine the current drawn by the motor at upf for a shaft load of 15MW and the excitation emf under these conditions. 4

B Explain the operating principle and torque-speed characteristics of the following single phase motors:-

a) Shaded pole motor; and 3

b) Two value capacitor motor. 3

Q5 With reasons, establish the correctness of following statements:-

a) The rotor mmf of a 3-phase induction motor rotates in space at the same speed of stator mmf. 2

b) Third harmonic currents flowing in the windings of a 3-phase alternator produce a stationary field in space . 2

c) Short pitched windings in a ac machines save copper, reduce emf induced in the windings and mitigate lower order harmonics. 2

d) The starting torque of a 3-phase induction motor depends upon the value of rotor resistance. 2

e) An over-excited synchronous motor is used for pf correction. 2

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