Ref. No. : Ex/IEBT/EE/T/123/2018

B.TECH INSTRUMENTATION AND ELECTRONICS ENGINEERING FIRST YEAR SECOND SEMESTER - 2018
ELECTRICAL MACHINES- II

Time : Three hours | **Full Marks: 100 (50 for each Part)**

Part-I

Use Separate Answer scripts for each Part

No. of questions		Answer **Question no 1** and any two *from the rest*	Marks
1.		Justify or nullify any two from the following with proper reason: (i) Induction machines cannot run at synchronous speed (ii) Increasing rotor resistance increases maximum torque of an induction motor (iii) pf of induction machine is normally high (iv) induction generator cannot absorb reactive power	2×5
2.	(a)	Why do we require a starter to start an induction motor? Briefly explain the operation of star delta starter used for starting a three phase induction motor.	4+6
	(b)	A 3-phase, 400V, 50Hz, 6 pole slip ring induction motor has a full-load speed of 950rpm. The rotor perphase resistance and standstill reactance are 0.5Ω and 1Ω respectively. Find (a) speed at which breakdown torque occurs (b) the resistance per phase to be added to the rotor to obtain maximum torque at starting (c) Full load speed with added rotor resistance.	10
3.	(a)	Derive and draw torque-speed characteristics of a polyphase induction machine. Mark different regions of operation.	10
	(b)	Following is the test data for a 3-phase, 50kW, 3.3kV, 50Hz, 4-pole squirrel cage induction motor. No load test: Voltage: 3.3kV, 50Hz. Current: 3A, Power: 2kW Blocked rotor test: Voltage: 400V, 20Hz, Current: 20A, Power: 12kW Stator DC resistance per phase: 5.5Ω. Calculate: (a) parameters of the induction machine equivalent circuit (b) draw the equivalent circuit mentioning the parameter values (b) stator current, pf when the motor operates at 5% slip.	10
4.	(a)	Using double revolving field theory, show that a single phase induction motor can run from a single phase AC supply once it is started, but cannot start by itself.	10
	(b)	With proper derivation discuss how two phase servo motor can be used in position control system.	10

B.Tech in I.E.E , 1st Year 2nd Semester Examination , 2018

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PART - II

Question No.			Marks
	Answer any three (question no. 3 carries the maximum marks).		
1.	(a)	Draw and explain the 'V' curves a synchronous motor and show lagging, leading and unity power factor on it.	6 + 2 +8
	(b)	What is the significance of load angle?	
	(c)	A synchronous motor is operating at 0.2 p.f. lag at half load. With E_f, V_t and X_s remaining constant, explain with the help of phasor diagram whether it's power factor is worsened or improved when it is made to operate at full load.	
2.	(a)	Derive the expression of reactive power of a cylindrical rotor alternator. Also derive the condition for maximum reactive power output.	8+8
	(b)	A 2200 V, 400 V, 3-phase star connected synchronous motor has synchronous impedance 0f 0.3 + j 3.0 Ω. Determine the excitation emf and the power angle if the motor works at rated load at 0.8 p.f. leading and with an efficiency of 94%.	
3.	(a)	What is the origin of harmonics in alternator induced voltage?	2+6+10
	(b)	How does winding factor help to suppress the harmonics?	
	(c)	The total flux per pole in the air gap of a 50 Hz a.c. generator is 0.069 Wb. If the flux density distribution is given by $B = B_1\sin\theta + B_3\sin3\theta + B_5\sin5\theta$ Where $B_3=(1/3)\ B_1$ and $B_5=(1/3)\ B_1$ and θ is the angle measured from interpolar axis, then determine the r.m.s. value of the e.m.f. per turn. The coil span is 0.8 of the pole pitch.	

Question No.		PART - II	Marks
4.	(a)	What are the space phasors and time phasors? Explain clearly in the context of synchronous machine.	4+5+7
	(b)	Describe the steps for determining voltage regulation by zero power factor characteristics method.	
	(c)	Describe Blondel's Tow Reaction theory for Salient pole Synchronous machine	
5.	(a)	Why synchronous motor is not self-start?	6+7+3
	(b)	What is synchronizing power coefficient and what is its physical significance? Derive it for salient pole synchronous machine.	
	(c)	Define steady state stability limit for a synchronous machine.	