U.S.N.

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E.
Branch: Electrical and Electronics Engineering
Course Code: 23EE4PCISM
Course: Induction Motors and Synchronous Machines

Semester: IV
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

			UNIT - I	*CO*	*PO*	**Marks**
1	a)		Draw the relevant phasor diagrams and hence show that the rotating magnetic field in a 3-ph induction motor has a constant magnitude	*CO1*	*PO1*	**08**
	b)		With a neat diagram, explain the T-S characteristics of a 3-ph induction Motor	*CO1*	*PO1*	**04**
	c)		A 3-ph induction motor having a 6-pole star connected stator winding runs on 240V, 50Hz supply. The rotor resistance and standstill reactance are 0.12 ohms and 0.85 ohms per phase respectively. The ratio of stator to rotor turns is 1.8. Full load slip is 4%. Calculate the developed torque at full load, maximum torque and speed at maximum torque.	*CO1*	*PO1*	**08**
			UNIT - II			
2	a)		Discuss the effect of cogging and crawling on the performance of 3-ph induction motor. Explain with neat diagrams.	*CO1*	*PO2*	**08**
	b)		Explain how high torque can be achieved using special rotor constructions in squirrel cage induction motors.	*CO1*	*PO2*	**08**
	c)		Draw the phasor diagram of a 3-phase induction motor on load.	*CO1*	*PO2*	**04**
			UNIT - III			
3	a)		What is the necessity of starters for a 3-ph induction motor? How a star-delta starter can be used for the purpose of starting	*CO1*	*PO3*	**08**
	b)		With the base of double field revolving theory, explain the principle of operation of a 1-ph induction motor	*CO1*	*PO3*	**06**
	c)		Determine the suitable auto transformer ratio for starting a 3-ph induction motor with line current not exceeding three times the full load current. The short circuit current is five times the full load current and full load slip is 5%. Also, estimate the starting torque in terms of the full load torque.	*CO1*	*PO3*	**06**

				OR			
4	a)		Enumerate the factors affecting the speed of a 3-ph induction motor? Explain one method of speed control from i) stator side ii) rotor side.	*CO1*	*PO3*	**08**
	b)		Explain the working of a capacitor start type of 1-ph induction motor. Support your answer with neat circuit diagrams and phasor diagrams	*CO1*	*PO3*	**06**
	c)		A 15hp(11.2kW), 3-ph, 6 pole, 50 Hz, 400V, delta connected induction motor runs at 960 rpm on full load. If it takes 86.4A on direct starting, find the ratio of starting torque to full load torque with a star-delta starter. Full load efficiency and power factor are 88% and 0.85 respectively.	*CO1*	*PO3*	**06**
			UNIT - IV			
5	a)		With necessary diagrams, distinguish between salient pole and non-salient pole type of rotor in synchronous machines.	*CO2*	*PO1*	**06**
	b)		Discuss different methods of starting of a 3-phase synchronous motor.	*CO2*	*PO1*	**06**
	c)		A three phase, 16 pole alternator has 144 slots and 10 conductors per slot. Flux per pole is 0.03 Wb and speed is 375 rpm. Find (i) frequency of generated emf, (ii) phase and line emf. The coil span is (5/6)th of the pole pitch.	*CO2*	*PO2*	**08**
			OR			
6	a)		What is hunting? List out its causes and effects. Also suggest a method for reducing hunting.	*CO2*	*PO1*	**07**
	b)		With a neat phasor diagram, deduce an expression for voltage regulation of an alternator by EMF method. Also mention why this method is called pessimistic method?	*CO2*	*PO1*	**07**
	c)		A three-phase star connected alternator is rated at 1600 KVA and 13500V. The effective armature resistance and synchronous reactance/phase are 1.5 Ω and 30 Ω respectively. Calculate percentage regulation for a load of 1280 kW at pf of (i) 0.8 lagging and (ii) unity	*CO2*	*PO2*	**06**
			UNIT - V			
7	a)		Discuss with necessary diagrams, all dark lamp method of synchronizing a three-phase alternator to the bus bar.	*CO3*	*PO4*	**06**
	b)		With the help of power angle diagram, explain power angle characteristic of a synchronous machine operating in generating mode and motoring mode.	*CO3*	*PO4*	**07**
	c)		Two single phase alternators operating in parallel have induced emfs on open circuit of $230\angle0^0$ and $230\angle10^0$ Volts and respective impedances of j2 Ω and j3 Ω. Calculate (i) terminal voltage (ii) currents and (iii) power delivered by each of the alternators to a load of impedance 6 Ω (resistive).	*CO3*	*PO4*	**07**

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