U.S.N.										

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

Autonomous Institute Affiliated to VTU

August 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**
Course Code: 23EE4PCISM **Max Marks: 100**
Course: Induction Motors and Synchronous Machines

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

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Obtain the torque equation of a three phase induction motor and discuss the effect of supply voltage on torque.	*CO1*	*PO1, PO2, PO3*	**07**
	b)		Compare squirrel cage rotor and slip ring rotor for three phase Induction motors	*CO1*	*PO1, PO2, PO3*	**06**
	c)		A three phase star connected slip ring induction motor has a maximum torque of 2.5 times the full load torque and the starting torque is 1.5 times the full load torque. Find the ratio of rotor resistance to rotor reactance per phase and full load slip of the motor.	*CO1*	*PO1, PO2, PO3*	**07**
			UNIT - II			
2	a)		What is the purpose of employing deep bar rotors and double cage rotors? Explain their working?	*CO1*	*PO1, PO2, PO3*	**08**
	b)		Equivalent circuit parameters of a three phase, 115V, 60Hz, star connected, 6 pole induction motor are given as: Stator impedance per phase = (0.07+j3) Ω; Equivalent rotor impedance per phase at standstill = (0.08+j3)Ω; magnetizing branch has Go = 0.022 mho and Bo = 0.15 mho. Find i) Secondary equivalent current on stator side ii) Primary current and iii) Primary power factor at a slip of 2% by using approximate equivalent circuit.	*CO1*	*PO1, PO2, PO3*	**08**
	c)		What is cogging and crawling in three phase induction motors?	*CO1*	*PO1, PO2, PO3*	**04**

			UNIT - III			
	3	a)	What is the necessity of Starters in three phase induction motors? Explain with the help[of a neat connection diagram working of star-delta starter.	*CO1*	*PO1, PO2, PO3*	**08**
		b)	What are the methods of starting single phase induction motors? Explain the operation and characteristics of capacitor start and capacitor run induction motors	*CO1*	*PO1, PO2, PO3*	**08**
		c)	List the factors affecting speed of a three phase induction motor.	*CO1*	*PO1, PO2, PO3*	**04**
			OR			
	4	a)	Explain why single phase induction motors are not self starting with the help of double revolving field theory.	*CO1*	*PO1, PO2, PO3*	**08**
		b)	A three phase induction motor takes 5 times the full load current at starting with normal voltage applied. Its full load slip is 4%. What auto transformer ratio would enable the motor to be started with not more than twice the full load current drawn from the supply at starting? What would be the starting torque in terms of full load torque under this condition?	*CO1*	*PO1, PO2, PO3*	**08**
		c)	List the types of single phase induction motors and their applications	*CO1*	*PO1, PO2, PO3*	**04**
			UNIT - IV			
	5	a)	"A three phase synchronous motor is not a self starting motor." Explain. Discuss any one method of starting it.	*CO2*	*PO1, PO2, PO3*	**08**
		b)	A 1000kVA, 3300V, three phase, star connected alternator delivers full load current at rated voltage at 0.8 pf lagging. The resistance and synchronous reactance of the machine per phase are 0.5 Ω and 5 Ω respectively. Estimate the terminal voltage for the same excitation and load current at 0.8 pf leading.	*CO2*	*PO1, PO2, PO3*	**08**
		c)	What is the phenomenon of hunting in synchronous machines? How can it be minimized?	*CO2*	*PO1, PO2, PO3*	**04**
			OR			
	6	a)	Discuss the nature and effect of Armature reaction in synchronous generators.	*CO2*	*PO1, PO2, PO3*	**08**

		b)	The following test results are obtained on a 6600V alternator. OC voltage(V): 3100, 4900, 6600, 7500, 8300 Field current (A): 16, 25, 37.5, 50, 70 A field current of 20 A is found necessary to circulate the full load current on the short circuit of the armature. Calculate the voltage regulation by Ampere turn method of the alternator at 0.8 pf lag. Neglect resistance and leakage reactance.	*CO2*	*PO1, PO2, PO3*	**08**
		c)	How do you determine the Short circuit current ratio of a synchronous machine (SCR)?	*CO2*	*PO1, PO2, PO3*	**04**
			UNIT - V			
	7	a)	Describe any one method of synchronizing the alternator with bus bars?	*CO3*	*PO3, PO4*	**08**
		b)	Two 3-phase, 6.6 kV, star connected alternators supply a load of 3000 kW at 0.8 p.f. lagging. The synchronous impedance per phase of machine A is (0.5 + j10) Ω and of machine B is (0.4 + j12) Ω. The excitation of machine A is adjusted so that it delivers 150 A at a lagging power factor and the governors are so set that the load is shared equally between the machines. Determine the current, power factor and induced emf of each machine.	*CO3*	*PO3, PO4*	**08**
		c)	What is reluctance power?	*CO3*	*PO3, PO4*	**04**

****