CBCS SCHEME

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BEE401

Fourth Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

Electric Motors

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Derive an expression for the armature torque of DC motor.	6	L3	CO1
	b.	Draw the power flow diagram for DC motor. Also explain the various losses which occurs in DC motor.	7	L1	CO1
	c.	The full load current of DC shunt motor is 80A at 220V. The shunt field current is 12A and armature resistance 0.055 Ω, find (i) Total copper losses (ii) Efficiency of the motor Consider the stray losses of 1000 Watts.	7	L3	CO1
		OR			
Q.2	a.	With a neat circuit diagram, explain the methods of speed control for DC shunt motor.	6	L2	CO1
	b.	Explain the Swinburne's test on DC machines.	7	L2	CO1
	c.	A test on two coupled similar motors, with their fields connected in series gave the following results : Motor : Armature current = 56 A, Armature voltage = 590 V, Voltage drop = 40 V Generator : Armature current = 44 A, Armature voltage = 400 V, Voltage drop = 40 V Resistance of each armature = 0.3 ohm Calculate the efficiency of the Motor and Generator.	7	L3	CO1
		Module – 2			
Q.3	a.	Analytically justify how a rotating field is created in three phase induction motor, when a balanced three phase AC supply is given.	10	L2	CO2
	b.	A three phase 50 Hz, 400 V induction motor has 4 poles star connected stator winding. Rotor resistance and reactance per phase are 0.15 Ω and 1 Ω. Full load slip is 5% Calculate (i) Total torque developed (ii) Maximum torque (iii) Speed at maximum torque Assume stator to rotor ratio 2 : 1	10	L3	CO2
		OR			
Q.4	a.	Sketch and explain the typical torque slip characteristics of a three phase induction motor.	10	L2	CO2
	b.	Derive the torque equation of a three phase induction motor and also condition of maximum torque.	10	L3	CO2

		Module – 3			
Q.5	**a.**	Starting from the fundamentals develop the equivalent circuit of a polyphase induction motor and explain how mechanical power developed is taken care of in the equivalent circuit.	**10**	**L2**	**CO3**
	b.	Describe the constructional features of a double cage and deep bar rotors of 3Φ induction motor and explain it.	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	A 415V, 29.84 kW, 50 Hz Delta connected motor gave the following test data: No load test – 415 V, 21A, 1250 W Blocked rotor test – 100 V, 45A, 2730 W Construct the circle diagram and determine (i) Line current and power factor for rated output. (ii) The maximum torque. Assume stator and rotor copper losses are equal at stand still.	**14**	**L2**	**CO3**
	b.	Explain the phenomenon of cogging and crawling in a 3ϕ induction motor.	**6**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Justify the necessity of starter for 3 phase induction motor. Explain star delta starter with neat sketch.	**10**	**L2**	**CO4**
	b.	List the types of speed control in induction motor, explain speed control by frequency of 3 phase induction motor.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	Explain double field revolving theory as applied to a single phase induction motor and prove that it cannot produce any starting torque.	**10**	**L2**	**CO4**
	b.	Explain construction, working and application of shaded pole motor.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Explain the operation of synchronous motor at constant load variable excitation and V and inverted V curve.	**10**	**L2**	**CO5**
	b.	With a neat diagram, explain the principle operation of a 3ϕ synchronous condenser.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain the construction, working and application of universal motor.	**10**	**L2**	**CO5**
	b.	With a neat diagram, explain working and application of two phase AC servo motor.	**10**	**L2**	**CO5**

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