Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN											Course Code	2	1	E	E	4	4

Fourth Semester B.E. Degree Examinations, September/October 2024

ELECTRICAL MACHINES-II

Duration: 3 hrs **Max. Marks: 100**

Note: ***1. Answer any* FIVE *full questions, choosing* ONE *full question from each module.***
2. Missing data, if any, may be suitably assumed.

Q. No		*Question*	*Marks*	*(RBTL:CO:PI)*
		MODULE – 1		
1.	**a.**	Describe the characteristics of DC shunt motor and write its applications	**06**	(2 :1 : 1.3.1)
	b.	What is back emf? Write its significance?	**06**	(2 :1 : 1.3.1)
	c.	A 20 HP, 4 pole, 250 V, lap connected DC shunt motor has 48 slots, each slot containing 20 conductors. It draws a current of 80 A from the supply. The field and armature resistances are 125 Ω and 0.2 Ω respectively. The flux per pole is 100 mWb and BCD = 1 V per brush. Calculate (i) Back emf (ii) Speed (iii) Gross Torque (iv) Useful Torque	**08**	(2 :1 : 1.3.1)
		OR		
2.	**a.**	With a neat sketch describe the working of 3 point starter.	**06**	(2 :1 : 1.3.1)
	b.	Derive an expression for the armature torque of DC motor.	**06**	(2 :1 : 1.6.1)
	c.	A 14.92 kW, 230 V, 1150 rpm, 4-pole, D.C. shunt motor has a total 620 conductors arranged in two parallel paths and the armature circuit resistance is 0.2 Ω. When it delivers rated power at rated speed, it draws a line current of 74.8 A and a field current of 3 A. Calculate (i) the flux per pole (ii) the torque developed in armature (iii) the rotational losses (iv) the total losses expressed as a percentage of power input.	**08**	
		MODULE – 2		
3.	**a.**	Explain Swinburne's test. State its merits and demerits.	**06**	(2 :2 : 1.6.1)
	b.	Explain back to back test of two identical DC machines and calculate the efficiency of the machine as motor and generator.	**06**	(2 :2 : 1.6.1)
	c.	A Retardation test is made on a separately excited DC machine as a motor. The induced voltage falls from 240 V to 220 V in 25 seconds on opening the armature circuit and in 6 seconds on suddenly changing the armature connection from supply to a load resistance which takes average current of 10 A. Find the efficiency of the machine when running as a motor taking a current of 25 A on a supply of 250 V. The resistance of its armature is 0.3 Ω and that of its field winding is 200 Ω.	**08**	(3 :3 : 1.3.1)
		OR		
4.	**a.**	Derive an expression for running torque of a 3-phase induction motor.	**06**	(2 :2 : 1.3.1)
	b.	Draw and explain the torque slip characteristics indicating motoring, generating and braking operating regions.	**06**	(3 :2 : 1.3.1)
	c.	A 440 V, 3-Ø, 50 Hz, 4 pole, star connected induction motor has a full load speed of 1425 rpm. The rotor has an impedance of (0.4+j4) Ω per phase and rotor/stator turn ratio of 0.8. Calculate (i) Full load Torque (ii) Full load copper loss (iii) maximum torque and the speed at which it occurs (iv) starting current.	**08**	(2 :2 : 1.6.1)

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

MODULE – 3

5.	**a.**	Draw and explain power flow diagram of 3-Ø induction motor. Also, obtain the equivalent circuit referred to the stator side of 3-Ø induction motor.	**10**	(2 :3 : 1.6.1)
	b.	A 3-Ø induction motor of 18.65 kW 4-pole, 50 Hz has friction and windage losses of 2.5% of the output. The full load slip is 4%, find (i) rotor copper loss (ii) rotor input (iii) shaft torque (iv) gross torque.	**10**	(2 :3 : 1.6.1)

OR

6.	**a.**	Explain the construction of double cage induction motor and how starting torque can be increased.	**08**	(2 :3 : 1.3.1)
	b.	A 415 V, 29.84 kW, 50 Hz, delta connected motor gave the following test data. No load test : 415 V, 21 A, 1250 W Blocked rotor test : 100 V, 45 A, 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.	**12**	(3 :3 : 1.3.1)

MODULE – 4

7.	**a.**	Mention the different speed control methods of 3-Ø induction motor. Explain any two methods.	**06**	(2 :4 : 1.3.1)
	b.	Explain the construction, operation, characteristics and applications of single phase capacitor start induction motor.	**06**	(3 :4 : 1.3.1)
	c.	Why starter is necessary for a 3-Ø induction motor? Explain the construction and operation of star-delta starter.	**08**	(2 :4 : 1.6.1)

OR

8.	**a.**	Explain the construction, operation, characteristics and applications of shaded pole motor.	**06**	(3 :4 : 1.3.1)
	b.	Explain the construction, operation, characteristics and applications of split-phase motor.	**06**	(2 :5 : 1.4.1)
	c.	Explain double revolving field theory of 1-Ø induction motor with torque-speed characteristics.	**08**	(3 :4 : 1.3.1)

MODULE – 5

9.	**a.**	What is hunting? Explain the causes and effects of hunting and how it is prevented.	**06**	(3 :5 : 1.3.1)
	b.	Why synchronous motor is not self-starting? Explain the different starting methods of synchronous motor.	**06**	(3 :5 : 1.3.1)
	c.	Analyze the operation of synchronous motor under variable excitation at constant load with vector diagrams? Also draw V and inverted V curves.	**08**	(3 :5 : 1.3.1)

OR

10.	**a.**	Explain the construction, operation, characteristics and applications of universal motor.	**06**	(3 :5 : 1.3.1)
	b.	Write a note on stepper motor and list types of it.	**06**	(3 :5 : 1.3.1)
	c.	Describe the construction, operation, characteristics and applications of BLDC motor.	**08**	(2 :5 : 1.3.1)

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Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**