Q. Code:634313

Reg. No. | | | | | | | | | | | | | |

M.E / M.TECH. DEGREE EXAMINATIONS, MAY 2024

Second Semester

PD22012 – SPECIAL ELECTRICAL MACHINES

(Electrical and Electronics Engineering)

(Regulation2022)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	To understand the principles of electromechanical energy conversion in electrical machines and to know the dynamic characteristics of DC motors	**3**
CO 2	To study the concepts related with AC machines, magnetic noise and harmonics in rotating electrical machines.	**3**
CO 3	To interpret the principles of reference frame theory	**4**
CO 4	To study the principles of three phase, doubly fed and 'n' phase induction machine in machine variables and reference variables.	**4**
CO 5	To understand the principles of three phase, synchronous machine in machine variables and reference variables.	**2**

PART- A(20x2=40Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	A four stack VR stepper motor has a step angle of 1.5°, find the number of its rotor teeth.	**1**	**3**
2.	For a three-phase variable reluctance stepper motor, give the logic sequence for half step mode.	**1**	**2**
3.	What is meant by slewing mode of operation in stepper motor?	**1**	**2**
4.	Name the methods used for fast decaying of current in stepper motor windings.	**1**	**3**
5.	Compare SRM with VR stepper motor.	**2**	**3**
6.	State the significance of closed loop control in SRM.	**2**	**2**
7.	Why SR machines popular in adjustable speed drives?	**2**	**3**
8.	Give the advantages of sensor less operation of Switched Reluctance machines.	**2**	**2**
9.	How are the directions of rotations reversed in case of PMBLDC motor?	**3**	**3**
10.	Classify BLDC motor based on the pole arc length.	**3**	**2**
11.	Mention some applications of PMBLDC motor.	**3**	**2**
12.	What are the materials used for making Hall IC pallet?	**3**	**2**
13.	Draw the Torque speed characteristics of PMSM and identify its permissible operating region.	**4**	**2**

14.	Compare and contrast synchronous reluctance motor (SyRM) with PMSM.	**4**	**3**
15.	Brief-up the advantages of load commutation in Permanent Magnet Synchronous Machines.	**4**	**2**
16.	A three phase, four pole star connected synchronous motor has 72 slots with 20 conductors per slot. Find its number of turns/phases.	**4**	**3**
17.	Justify the reason for using synchronwes relvetance motor (SyRM) in recording instruments and spinning mills.	**5**	**3**
18.	List the characteristic features of Hysteresis Motor.	**5**	**2**
19.	A 3 phase, 4 pole, 50Hz, 400V star connected synchronous reluctance motor has direct axis and quadrature axis synchronous reactance of 8Ω and 2Ω respectively. For a load torque of 80N-m, find load angle.	**5**	**3**
20.	The frequency of applied voltage to a linear induction motor is 50Hz.The pole pitch of its double – sided primary is 10cm. Find its synchronous velocity.	**5**	**3**

PART- B (5x 10=50Marks)

			Marks	CO	RBT LEVEL
21. (a)		With neat sketch and phasor diagram, discuss the principle of operation of a stepper motor having very slow dynamic response.	**(10)**	**1**	**3**
		(OR)			
(b)	**(i)**	What is the problem in basic power driver circuit of a stepper motor? Briefly explain any one method of driver circuit overcoming it.	**(6)**	**1**	**3**
	(ii)	A stepper motor has a resolution of 500 steps/revolution in single phase ON mode. Find its resolution in half step mode. Find the number of steps required for the rotor to move a distance of 72°.	**(4)**	**1**	**3**
22. (a)		Explain the torque speed characteristics of doubly salient pole machine.	**(10)**	**2**	**2**
		(OR)			
(b)		Describe any two types of power controller circuits applicable to switched reluctance motor and explain the operation with suitable circuit diagram.	**(10)**	**2**	**2**
23. (a)		Compare electronic commutator in PMBLDC motor with mechanical commutator. Also explain its constructional aspects of design.	**(10)**	**3**	**4**
		(OR)			

(b)	**(i)**	Analysis the magnetic circuit relevant to PMBLDC motor. Also draw its characteristics.	**(6)**	**3**	**4**
	(ii)	A BLDC motor has a stall torque of 1.2 Nm with a current of 6 A. Determine its no load speed when fed from a 30V DC supply.	**(4)**	**3**	**4**
24. (a)		Derive the emf and torque equation of BLPM sine wave motor.	**(10)**	**4**	**3**
		(OR)			
(b)		Write a detailed technical note on the following: (i) Self-control scheme in Permanent Magnet Synchronous Motor. (ii) Microprocessor based control scheme of PMSM.	**(10)**	**4**	**3**
25. (a)		Discuss the performance characteristics of AC Series motor and also compare its torque- speed characteristics with DC series motor.	**(10)**	**5**	**3**
		(OR)			
(b)		Explain the construction and working principle of a motor which has no synchronous starting torque and runs up by induction action.	**(10)**	**5**	**3**

PART- C (1x 10=10Marks)

(Q.No.26 is compulsory)

			Marks	CO	RBT LEVEL
26.		A BLDC motor has a no-load speed of 6000 rpm when connected to 120V DC source. Armature resistance is 2.5Ω. Evaluate the speed when it is supplied with 60V and developing a torque of 0.5 Nm. Neglect constant losses. The no load current is 1A.	**(10)**	**3**	**5**

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