Q. Code: 247700

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

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Eighth Semester

EE18016 – SPECIAL ELECTRICAL MACHINES

(Electrical and Electronics Engineering)

(Regulation 2018)

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

CO 1 Design a stepper motor drive for an application.
CO 2 Learn the principle and characteristics of a synchronous reluctance motor drive.
CO 3 Configure a switched reluctance motor drive for an application.
CO 4 Understand the operation and control of a PMBLDC motor drive.
CO5 Learn the operation and control of a permanent magnet synchronous motor drive

PART- A (10 x 2 = 20 Marks)

		CO	RBT LEVEL
1.	Determine the step angle of a 4 phase stepper motor with 8 stator teeth and 6 rotor teeth.	**1**	**3**
2.	Write the excitation sequence table for a 4-phase VR stepper motor to rotate by an angle of 45°.	**1**	**3**
3.	Differentiate synchronous motor and synchronous reluctance motor.	**2**	**3**
4.	A 3 phase, 4 pole, 50 Hz, 400 V star connected synchronous reluctance motor has direct axis and quadrature axis synchronous reactances of 8 Ω and 2 Ω respectively. For a load torque of 80 N-m, determine the load angle.	**2**	**3**
5.	List the advantages of sensorless operation of switched reluctance motor.	**3**	**2**
6.	Justify the reason of using SRM in washing machines.	**3**	**3**
7.	What is meant by hall effect? List any two materials used to make hall IC pallet.	**4**	**2**
8.	Draw the magnetic equivalent circuit of PMBLDC motor.	**4**	**2**
9.	Define synchronous reactance in PMSM.	**5**	**2**
10.	Distinguish PMSM from PMBLDC motor.	**5**	**3**

PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11. (a)		Identify a stepper motor in which direction of rotation is independent of polarity of stator current. Explain its construction and various modes of excitation.	**(14)**	**1**	**3**
		(OR)			
(b)	**(i)**	A stepper motor is under running condition. Illustrate its characteristics and define the necessary terms involved.	**(7)**	**1**	**3**
	(ii)	Briefly explain, various types of circuits used for fast decaying of current in the winding in stepper motor.	**(7)**	**1**	**3**

12. (a)	Explain the construction based on rotor types and working principle of a motor which has no synchronous starting torque and runs up by induction action.	**(14)**	**2**	**3**
	(OR)			
(b)	Derive the torque equation of synchronous reluctance motor from its phasor diagram.	**(14)**	**2**	**3**
13. (a)	List the various power controller circuits applicable to doubly salient pole motor and explain the operation of any two schemes with suitable circuit diagram.	**(14)**	**3**	**2**
	(OR)			
(b)	Draw and explain the general torque-speed characteristics of SRM and discuss the type of control strategy used for different regions of the curve. Sketch the typical phase current waveforms during low speed operation.	**(14)**	**3**	**2**
14. (a)	Draw and explain the operation of electronic commutator. Also in constructional aspects compare with mechanical commutator.	**(14)**	**4**	**3**
	(OR)			
(b)	**(i)** Sketch the structure of the controller for PMBLDC motor and explain the functions of various blocks.	**(8)**	**4**	**3**
	(ii) A permanent magnet DC motor has a no load speed of 6000 rpm, when connected to 230 V supply. The armature resistance is 1.2 Ω. Compute the speed when the supply voltage is 115 V and torque is 0.5 NM. Neglect constant losses.	**(6)**	**4**	**3**
15. (a)	Derive the emf and torque equation of an ideal sine wave PM motor.	**(14)**	**5**	**3**
	(OR)			
(b)	**(i)** Explain the microprocessor based control of PMSM with a neat block diagram and list out its advantages.	**(8)**	**5**	**3**
	(ii) A three phase, four-pole star connected synchronous motor has 72 slots with 20 conductors per slot. The flux/pole is 0.05 Wb and the speed is 1500 rpm. Assuming the full-pitched coil, find the line and phase voltage.	**(6)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	A permanent magnet stepper motor is driven by a series of pulses of duration 20 ms.It has four stator poles and six rotor poles. Compute the time taken for the motor to make a complete rotation? Also, justify the reason for selection of stepper motor in computer printers.	**(10)**	**1**	**4**

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