Q. Code:515116

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

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

Sixth & Eighth Semester

EE18016 – SPECIAL ELECTRICAL MACHINES

(Electrical and Electronics Engineering)

(Regulation 2018/2018A)

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

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Design a stepper motor drive for an application.	**4**
CO 2	Learn the principle and characteristics of a synchronous reluctance motor drive.	**3**
CO 3	Configure a switched reluctance motor drive for an application.	**3**
CO 4	Understand the operation and control of a PMBLDC motor drive.	**3**
CO 5	Learn the operation and control of a permanent magnet synchronous motor drive.	**3**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Stepper Motor works in external logic. Justify.	**1**	**4**
2.	A stepper motor has a step angle of 1.8° and is driven 4000 pulse per second. Determine resolution and motor speed.	**1**	**3**
3.	Obtain the synchronous speed for a three phase , 4 pole , 60 Hz star connected reluctance motor.	**2**	**4**
4.	Compare and contrast of axial and radial gap motors.	**2**	**3**
5.	Compute the step angle of an 5 phase Switched Reluctance motor and commutation frequency in each phase for the speed of 5000 rpm.SRM having 10 stator poles and 4 rotor poles.	**3**	**4**
6.	Identify the speed in which chopping mode of control is employed in Switched Reluctance Motor. Justify the reason.	**3**	**4**
7.	Comment on the demagnetization in Permanent Magnet brushless DC motor.	**4**	**3**
8.	A Permanent Magnet brushless DC motor has torque constant 0.1Nm/A referred to DC supply. Find no load speed when connected to 48V DC supply.	**4**	**4**
9.	Categorize the assumptions made in deriving EMF equation of Permanent Magnet Synchronous Motor.	**5**	**2**
10.	Infer the relation between direct axis and quadrature axis current of Permanent Magnet Synchronous Motor.	**5**	**3**

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	Discuss the microprocessor based control of Stepper motor with an example.	**(14)**	**1**	**3**
	(OR)			
(b)	Construct and analyse the operation of single-stack and multi-stack Variable Reluctance stepper motor.	**(14)**	**1**	**3**
12. (a)	Depict the phasor diagram, obtain the torque equation of Synchronous Reluctance motor and analyse the torque angle curve.	**(14)**	**2**	**4**
	(OR)			
(b)	A 3-phase,400V,50Hz,4-pole, star-connected Synchronous Reluctance motor, with negligible armature resistance has X_{sd} =8Ω and X_{sq}= 2Ω. For a load torque of 80N-m, calculate (a) the load angle (b) the line current (c) the input power factor. Neglect rotational losses.	**(14)**	**2**	**4**
13. (a)	Analyse,compare and discuss the power semiconductor switching circuits of Switched Reluctance motor.	**(14)**	**3**	**3**
	(OR)			
(b)	Examine the need for limiting the phase current in Switched Reluctance motor and discuss the types.	**(14)**	**3**	**3**
14. (a)	Develop three phase Unipolar and Bipolar Permanent Magnet brushless DC motor drive and mention the principle of position detection using Hall elements.	**(14)**	**4**	**3**
	(OR)			
(b)	Develop the closed loop control of Permanent Magnet brushless DC motor drive with six power devices and control circuits.Also highlight the significance of rotor position sensors.	**(14)**	**4**	**3**
15. (a)	Deduce how the self controlled Permanent Magnet Synchronous motor drive adjusts the torque angle electronically by implementing closed loop control of load commutated inverter fed PMSM.	**(14)**	**5**	**3**
	(OR)			
(b)	Obtain the torque and current relationship from the phasor diagram for Permanent Magnet Synchronous motor to improve the dynamic response .	**(14)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	A three phase four pole synchronous motor has 36 stator slots. Each phase winding is made up of three coils per pole with 20 turns per coil. The coil span is seven slots. If the fundamental component of magnet flux is 1.8 mwb,calculate the open circuit phase emf (E_q) at 3000 rpm.	**(10)**	**5**	**4**

****