Reg. No.															

Question Paper Code	13221

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Seventh Semester

Electrical and Electronics Engineering

20EEEL713 – SPECIAL ELECTRICAL MACHINES

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	A variable reluctance stepper motor is constructed of _____ material with salient poles. (a) Paramagnetic (b) Ferromagnetic (c) Diamagnetic (d) Non-magnetic	1	K1	CO1
2.	What is the purpose of the rotor position detection in a stepper motor system? (a) To determine the step angle (b) To Synchronize the motors rotation (c) To provide feedback for closed-loop control (d) To regulate the motor's speed	1	K1	CO1
3.	For a stepper motor which torque has the highest numerical value (a) Pull- out torque (b) Pull -in torque (c) Detent Torque (d) Holding torque	1	K1	CO1
4.	What is the difference between full-step and half-step? (a) In full-step two phases are on and in half-step only one phase is on. (b) More resonance is evident in half-step (c) More power required for full-step (d) Half-step offers better resolution	1	K1	CO1
5.	Which type of SRM is most suitable for analysis using the Analytical Method? (a) Large-size SRM (b) High-speed SRM (c) Variable reluctance SRM (d) Permanent magnet SRM	1	K1	CO2
6.	Which power controller is commonly used in Switched Reluctance Motors (SRMs) to control the phase current? (a) Pulse Width Modulation (PWM) controller (b) Variable Frequency Drive (VFD) (c) Thyristor-based controller (d) On/Off switch controller	1	K1	CO2
7.	The rotor of the switched reluctance motor consists of (a) Die-cast iron (b) Squirrel cage rotor (c) Salient poles (d) Three phase winnings	1	K1	CO2
8.	In sensorless operation of an SRM, which method is used to initialize the rotor position? (a) Rotor position estimation based on the initial current flow (b) Mechanical alignment of the rotor with the stator poles (c) Estimation based on the motor's rated speed and inertia (d) Manual input of the rotor position during motor startup	1	K1	CO2
9.	Magnetic circuit analysis in Permanent Magnet Brushless D.C. (PMBLDC) motors is used to determine the _____. (a) Mechanical load angle (b) Torque-speed characteristics (c) Copper losses (d) Magnetic flux distribution	1	K1	CO3
10.	Electronic commutator is kept on (a) Rotor (b) stator (c) Both stator and rotor (d) None of the mentioned	1	K1	CO3

11.	BLPM square wave motor is classified in to _____ (a) 180degrees pole arc (b) 120 degrees pole arc (c) Both 120 and 180 pole arc (d) None of the mentioned	*1*	*K1*	*CO3*
12.	In brushless DC motor, the starting characteristic is equal to ____ (a) Induction motor (b) Compound motor (c) DC series motor (d) DC shunt motor	*1*	*K1*	*CO3*
13.	For which type of rotor permanent magnets are located on the rotor periphery (a) Interior rotor (b) Peripheral rotor (c) Claw pole (d) Transverse rotor	*1*	*K1*	*CO4*
14.	The whole working of the PMSM depends on the _____ between stator and the rotor with no load (a) Magnetic Locking (b) Air gap (c) Synchronism (d) None of the mentioned	*1*	*K1*	*CO4*
15.	The electronic commutator acts as an_____whose frequency is influenced by the rotor speed (a) Ideal inverter (b) Ideal converter (c) Ideal chopper (d) None of the mentioned	*1*	*K1*	*CO4*
16.	Permanent magnet synchronous motors are (a) Brushed ac synchronous motor (b) Brushless ac synchronous motor (c) Commutator synchronous motor (d) None of the mentioned	*1*	*K1*	*CO4*
17.	For a reluctance motor, the maximum average torque occurs when δ = _____ (a) 45° (b) 90° (c) 0° (d) 180°	*1*	*K1*	*CO5*
18.	The hysteresis motor operates on _____ power. (a) Single-phase (b) Two-phase (c) Three-phase (d) Four-phase	*1*	*K1*	*CO5*
19.	In repulsion motor, zero torque is developed when (a) Brush axis is 45^0 electrical to field axis (b) Brush axis coincides with the field axis (c) Brush axis is 90^0 electrical to field axis (d) Both (b) and (c)	*1*	*K1*	*CO5*
20.	What is the standard form of LIM? (a) Linear Induction Motor (b) Line Induction Motor (c) Lane Induction Motor (d) Linear Internal Motor	*1*	*K1*	*CO5*

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21.	Classify the different modes of excitation in a stepper motor.	*2*	*K2*	*CO1*
22.	Calculate the stepping angle of 3 phase 24 pole permanent magnet stepping motor.	*2*	*K2*	*CO1*
23.	Outline the applications of SRM.	*2*	*K2*	*CO2*
24.	Classify current control techniques of SRM.	*2*	*K2*	*CO2*
25.	What are the differences between mechanical and electronic commutators?	*2*	*K1*	*CO3*
26.	What are the types of permanent magnet DC motor?	*2*	*K1*	*CO3*
27.	Write the emf equation of PMSM.	*2*	*K2*	*CO4*
28.	Classify the rotors available in PMSM motor.	*2*	*K1*	*CO4*
29.	State the basic principle of operation of synchronous reluctance motor.	*2*	*K1*	*CO5*
30.	What is the principle of operation of a linear induction motor?	*2*	*K1*	*CO5*

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31.	a)	Discuss in detail about different types of power driver circuits for stepper motor.	*10*	*K2*	*CO1*
		OR			
	b)	Explain microprocessor based control of stepper motor with a neat block diagram.	*10*	*K2*	*CO1*

32.	a)	What is the necessity of the converter circuits for switched reluctance motor? Draw and explain the different types of converter circuits in detail.	*10*	*K2*	*CO2*
		OR			
	b)	Enumerate the various operating modes of SRM with neat diagram.	*10*	*K2*	*CO2*
33.	a)	Derive the Torque and EMF equations of PMBLDC Motor.	*10*	*K2*	*CO3*
		OR			
	b)	Explain the closed loop control scheme of a permanent magnet brushless dc motor drive with a suitable schematic diagram.	*10*	*K2*	*CO3*
34.	a)	Derive the expression for power input and torque of a PMSM. Explain how its torque speed characteristics obtained.	*10*	*K2*	*CO4*
		OR			
	b)	Discuss the current control scheme of permanent magnet synchronous motor in detail.	*10*	*K2*	*CO4*
35.	a)	Explain the construction and principle of operation of synchronous reluctance motor with neat diagrams.	*10*	*K2*	*CO5*
		OR			
	b)	Derive the torque equation of synchronous reluctance motor.	*10*	*K2*	*CO5*
36.	a) i)	Deduce an expression for synchronous reactance of PMSM	*5*	*K2*	*CO4*
	ii)	Describe the principle of operation of Repulsion Motor	*5*	*K2*	*CO5*
		OR			
	b) i)	Explain the power controllers used in PMSM.	*5*	*K2*	*CO4*
	ii)	Describe the Principle of operation of Hysteresis motor with its application.	*5*	*K2*	*CO5*