SIDDHARTH INSTITUTE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS), PUTTUR

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QUESTION BANK (DESCRIPTIVE)

Subject with Code : AC DRIVES (25EE2114)

Course & Branch: M. Tech –POWER ELECTRONICS

Year & Semester: I - M. Tech. & II-Semester **Regulation:** R25

UNIT I

INDUCTION MOTOR DRIVES

1.	(a)	Explain the control of induction motor drives and discuss the importance of speed control in industrial applications.	[L2][CO1]	5M
	(b)	Describe the principle of scalar control (V/f control) of an induction motor.	[L2][CO1]	5M
2.	(a)	A 3-phase induction motor operates at 400 V, 50 Hz under rated condition. If the frequency is reduced to 20 Hz, calculate the stator voltage required to maintain constant air-gap flux under V/f control.	[L3][CO1]	5M
	(b)	Discuss the limitations of scalar control methods in induction motor drives.	[L2][CO1]	5M
3.	(a)	Explain the principle of vector control (field-oriented control) of induction motors.	[L2][CO1]	5M
	(b)	Compare scalar control and vector control techniques used in induction motor drives.	[L4][CO1]	5M
4.		Explain the Direct Torque Control (DTC) of an induction motor drive with a neat block diagram. Discuss its advantages and disadvantages.	[L2][CO1]	10M
5.	(a)	Explain the concept of sensor less control of induction motor drives.	[L2][CO1]	5M
	(b)	Describe the role of flux observers in sensor less control of induction motors.	[L2][CO1]	5M
6.		A 3-phase induction motor has the following rotor parameters, Rotor resistance $R_2 = 0.6\Omega$; Rotor reactance $X_2 = 1.8\Omega$; Slip $s = 0.05$. Calculate the electromagnetic torque assuming stator voltage and machine constants are unity.	[L3][CO1]	10M
7.		In a V/f controlled induction motor drive, rated voltage and frequency are 460 V and 50 Hz. Calculate: (i) Voltage required at 30 Hz to maintain constant flux. (ii) Percentage reduction in voltage.	[L3][CO1]	10M
8.	(a)	Derive the dq0 model of a three-phase induction motor using Park's transformation.	[L4][CO1]	5M
	(b)	Explain the advantages of dq0 modeling in simulation studies of induction motor drives.	[L3][CO1]	5M
9.		Explain the direct torque and flux control of an induction motor with a suitable block diagram and discuss its performance characteristics.	[L2][CO1]	10M
10.		A utility-friendly induction motor drive draws 35 A from a 415 V, 3-phase supply with a power factor of 0.8. Calculate: (i) Input power drawn by the drive. (ii) Explain how utility-friendly drives improve power quality and reduce harmonics.	[L3][CO1]	10M

UNIT II

CONTROL TECHNIQUES OF IM DRIVES

1.		Explain the direct vector control of an induction motor drive with a neat block diagram. Discuss its advantages and limitations.	[L2][CO2]	10M
2.	(a)	Explain the indirect vector control of an induction motor drive with feedback using a block diagram.	[L2][CO2]	5M
	(b)	Discuss the importance of rotor flux estimation in indirect vector control.	[L2][CO2]	5M
3.		A 4-pole induction motor is controlled using vector control and supplied at 50 Hz. Calculate: (i) Synchronous speed, (ii) Rotor speed if slip = 2.5%, (iii) Rotor angular speed in rad/sec.	[L3][CO2]	10M
4.		Explain the indirect vector control with feed-forward compensation and discuss its role in improving the dynamic response of IM drives.	[L2][CO2]	10M
5.	(a)	Explain the decoupling principle in vector control of induction motors.	[L2][CO2]	5M
	(b)	Discuss how feed-forward compensation improves decoupling between flux and torque components.	[L4][CO2]	5M
6.		In a vector-controlled induction motor drive, the d-axis current component i_d is 4 A and the q-axis current component i_q is 7 A. Calculate: (i) Magnitude of stator current vector, (ii) Explain the physical significance of i_d and i_q in torque and flux control.	[L3][CO2]	10M
7.		A Direct Torque Control (DTC) drive has a reference torque of 25 Nm and the actual torque is 22 Nm. Determine the torque error and Explain the switching decision of the inverter based on torque and flux hysteresis controllers.	[L3][CO2]	10M
8.		Explain the sensorless control of induction motor drives and discuss different speed estimation techniques used in IM drives.	[L2][CO2]	10M
9.	(a)	Explain the speed control of wound rotor induction motor using rotor side control.	[L2][CO2]	5M
	(b)	A 6-pole wound rotor induction motor operates at 50 Hz with slip = 4%. Calculate the rotor speed.	[L3][CO2]	5M
10.	(a)	Explain the principle of five-phase induction motor drives.	[L2][CO2]	5M
	(b)	Discuss the advantages of multiphase induction motor drives over three-phase drives in high-power applications.	[L4][CO2]	5M

UNIT III

SYNCHRONOUS MOTOR DRIVES

1.	(a)	Explain the control of synchronous motor drives and discuss their advantages in variable speed applications.	[L2][CO3]	5M
	(b)	Explain the principle of self-controlled synchronous motor drive with a neat block diagram.	[L2][CO3]	5M
2.	(a)	Explain the vector control of synchronous motor and discuss how torque and flux are independently controlled.	[L2][CO3]	5M
	(b)	Compare vector control of synchronous motor and induction motor drives.	[L4][CO3]	5M
3.		A 3-phase synchronous motor has 8 poles and is supplied with 50 Hz frequency. Calculate: (i) Synchronous speed, (ii) Mechanical angular speed in rad/s, (iii) Speed if the supply frequency is reduced to 30 Hz.	[L3][CO3]	10M

4.		A synchronous motor operates at 415 V, 50 Hz and draws 30 A at 0.9 power factor lagging. Calculate: (i) Input power to the motor, (ii) Reactive power drawn by the motor.	[L3][CO3]	10M
5.	(a)	Explain the cycloconverter-fed synchronous motor drive with a block diagram.	[L2][CO3]	5M
	(b)	Discuss the advantages of cycloconverter drives in high power synchronous motor applications.	[L2][CO3]	5M
6.		A 6-pole synchronous motor is supplied from a variable frequency drive. Calculate: (i) Speed of the motor when supply frequency is 40 Hz. (ii) Speed when frequency is increased to 60 Hz.	[L3][CO3]	10M
7.	(a)	Explain the control of synchronous reluctance motor with suitable diagrams.	[L2][CO3]	5M
	(b)	Discuss the advantages of synchronous reluctance motors in electric drives.	[L2][CO3]	5M
8.		A 3-phase synchronous motor develops 50 Nm torque at a speed of 1500 rpm. Calculate the mechanical output power developed by the motor.	[L3][CO3]	10M
9.		A self-controlled synchronous motor drive operates at 1200 rpm and develops 40 Nm torque. Calculate: (i) Mechanical output power, (ii) Power in kW.	[L3][CO4]	10M
10.	(a)	Explain the principle of operation of synchronous motor drives using inverter-fed control.	[L2][CO4]	5M
	(b)	Discuss the advantages and applications of synchronous motor drives in modern industrial systems.	[L2][CO4]	5M

UNIT IV

PERMANENT MAGNET MOTOR DRIVES

1.		Explain the types, construction, and operating principle of Permanent Magnet Synchronous Motors (PMSM) with suitable diagrams.	[L2][CO4]	10M
2.	(a)	Derive the expression for electromagnetic torque of a PMSM.	[L4][CO4]	5M
	(b)	Explain the dq-axis model of PMSM and its significance in motor control.	[L2][CO4]	5M
3.		A 4-pole PMSM is supplied from a variable frequency drive at 50 Hz. Calculate: (i) Synchronous speed, (ii) Mechanical angular speed in rad/s.	[L3][CO4]	10M
4.	(a)	Explain the mathematical model of PMSM in the dq reference frame.	[L4][CO4]	5M
	(b)	Discuss the advantages of PMSM over conventional synchronous motors	[L2][CO4]	5M
5.	(a)	Explain the implementation of vector control for PMSM drives with a block diagram.	[L2][CO4]	5M
	(b)	Discuss the role of current controllers in PMSM vector control.	[L2][CO4]	5M
6.		A PMSM develops a torque of 40 Nm at a speed of 1500 rpm. Calculate the mechanical output power developed by the motor.	[L3][CO4]	10M
7.		A BLDC motor drive operates at 48 V and draws 20 A. Calculate: (i) Electrical input power, (ii) If efficiency is 85%, determine the mechanical output power.	[L3][CO4]	10M
8.	(a)	Explain the construction and working principle of a BLDC motor drive.	[L2][CO5]	5M
	(b)	Compare BLDC motors and PMSM drives in terms of control and performance.	[L4][CO5]	5M
9.	(a)	Explain the construction and operating principle of a PMDC motor drive.	[L2][CO5]	5M
	(b)	A PMDC motor operates at 220 V and draws 8 A.	[L3][CO5]	5M

		Calculate the input electrical power to the motor.		
10.	(a)	Discuss the applications and advantages of permanent magnet motor drives in modern electric drive systems.	[L2][CO5]	5M
	(b)	A Permanent Magnet DC (PMDC) motor operates at 220 V and draws 10 A. If the motor efficiency is 88%, calculate: Input electrical power, Mechanical output power of the motor.	[L3][CO5]	5M

UNIT V

SRM DRIVE & ITS CONTROLLER

1.		Explain the construction and operating principle of a Switched Reluctance Motor (SRM) with suitable diagrams.	[L2][CO5]	10M
2.	(a)	Derive the torque expression of SRM and explain the significance of inductance variation.	[L4][CO5]	5M
	(b)	Explain the SRM configuration and controller design with a neat block diagram.	[L2][CO5]	5M
3.		In an SRM, the phase inductance changes from 10 mH to 40 mH when the rotor moves from the unaligned to aligned position. If the phase current is 8 A, calculate the developed electromagnetic torque using the torque expression.	[L2][CO5]	10M
4.	(a)	Explain different converter topologies used for SRM drives.	[L2][CO5]	5M
	(b)	Discuss the control strategies used in SRM drives for torque and speed control.	[L2][CO5]	5M
5.	(a)	Explain the sensor less control technique in SRM drives.	[L2][CO6]	5M
	(b)	Discuss the advantages of sensor less control in electric drives.	[L2][CO6]	5M
6.		A Switched Reluctance Motor drive operates at 600 rpm and develops a torque of 30 Nm. Calculate the mechanical output power of the motor.	[L3][CO6]	10M
7.		A DC drive operates at 220 V and draws 12 A with an efficiency of 90%. Calculate: (i) Input power, (ii) Mechanical output power.	[L3][CO6]	10M
8.	(a)	Explain the principles of fuzzy logic control in electrical drives.	[L2][CO6]	5M
	(b)	Explain the design methodology and block diagram implementation of a DC drive using fuzzy logic controller.	[L2][CO6]	5M
9.	(a)	Explain the adaptive speed control of induction motor drives using neural networks.	[L2][CO6]	5M
	(b)	Discuss the advantages of neural network-based control over conventional control methods.	[L4][CO6]	5M
10.		Explain the MATLAB simulation of fuzzy logic speed control of a three-phase induction motor drive and discuss the key simulation results.	[L2][CO6]	10M

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