SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

VI SEMESTER

EE3662 -SOLID STATE DRIVES

Regulation – 2023

Academic Year 2025-2026 (Even)

Prepared by

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SUBJECT : EE3662 -SOLID STATE DRIVES

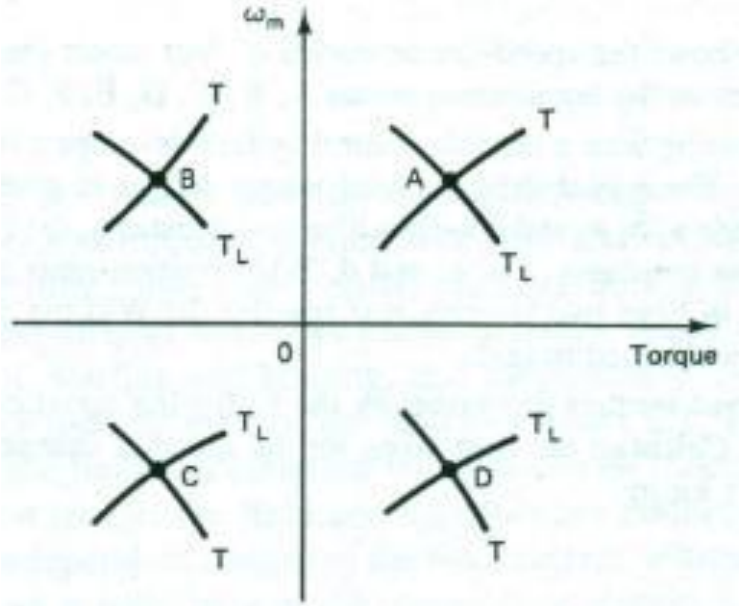
SEM / YEAR : III / VI

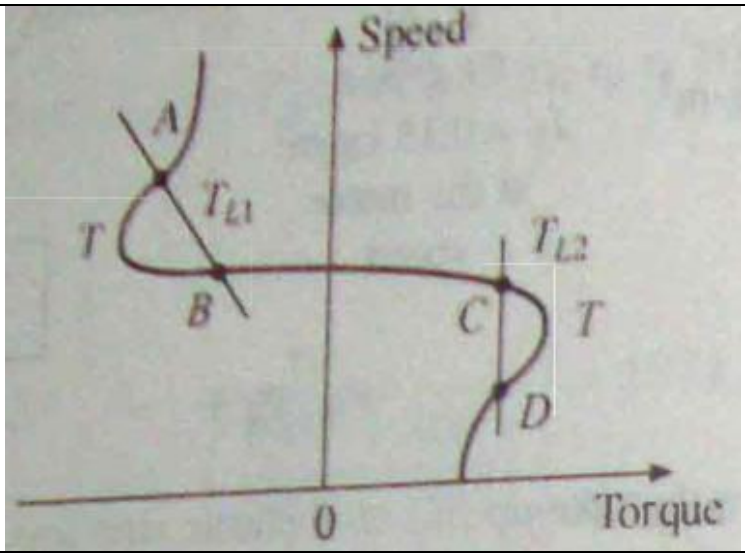
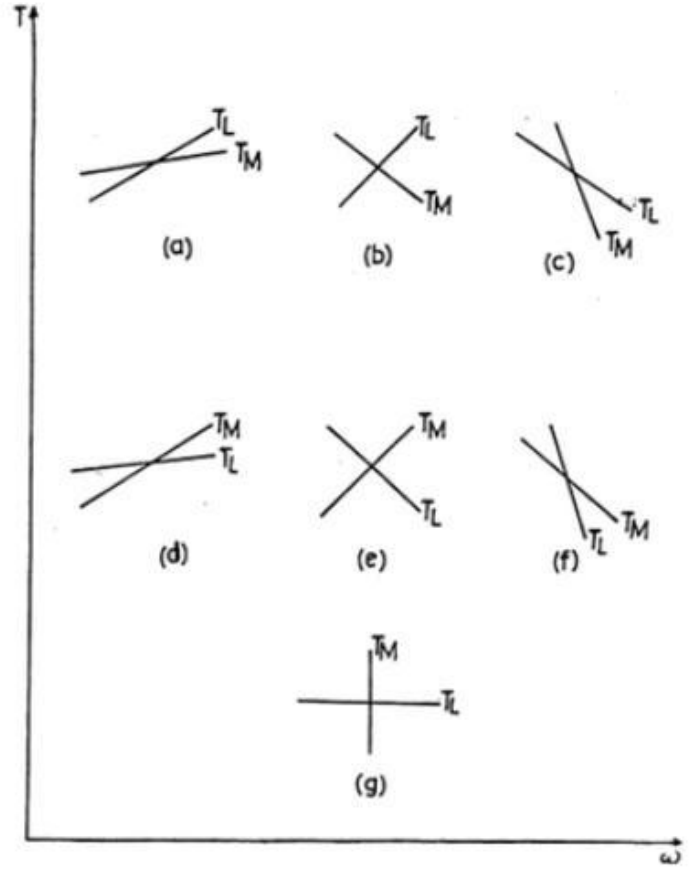
UNIT-I - DRIVE CHARACTERISTICS

Electric drive – AC and DC Drives - Equations governing motor load dynamics – steady state stability– multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor, modes of operation.

PART-A

Q. No	Questions	BT Level	Competence	CO
1	List the types of load torques.	BTL 1	Remember	CO1
2	State the fundamental torque equation of a motor load.	BTL 1	Remember	CO1
3	Define active load torque and passive load torque with examples.	BTL 1	Remember	CO1
4	List the typical elements of an electric drive.	BTL 1	Remember	CO1
5	Define an electrical drive.	BTL 1	Remember	CO1
6	Define regenerative braking.	BTL 1	Remember	CO1
7	State the condition for steady-state stability of a motor.	BTL 1	Remember	CO1
8	Sketch the torque–speed characteristics of a hoist load mechanism.	BTL 1	Remember	CO1
9	Define dynamic braking.	BTL 1	Remember	CO1
10	Classify the different types of loads with examples.	BTL 1	Remember	CO1
11	List the different modes of operation of an electric drive.	BTL 1	Remember	CO1
12	State the conditions required to obtain the three modes of operation of an electric drive.	BTL 1	Remember	CO1
13	Explain the conditions required for regenerative braking operation.	BTL 2	Understand	CO1
14	Explain the types of electric braking.	BTL 2	Understand	CO1
15	Explain whether braking is applicable to all types of motors with an example.	BTL 2	Understand	CO1
16	Explain the block diagram of an electrical drive system with labels.	BTL 2	Understand	CO1
17	Explain the multi-quadrant dynamics in drive characteristics.	BTL 2	Understand	CO1
18	Explain the factors considered for the selection of an electrical drive.	BTL 2	Understand	CO1
19	Illustrate an electric drive and explain its classification.	BTL 2	Understand	CO1

20	Explain the speed–torque conventions used in multi-quadrant operation.		BTL 2	Understand	CO1
21	Explain the advantages of electric drives.		BTL 2	Understand	CO1
22	Explain the condition for acceleration of a motor–load system.		BTL 2	Understand	CO1
23	Explain the action of a drive system when motor torque becomes greater than load torque due to external disturbances.		BTL 2	Understand	CO1
24	Explain the action of a drive system when load torque becomes greater than motor torque due to external disturbances.		BTL 2	Understand	CO1
	PART-B				
1	Analyze the multi quadrant dynamics of any suitable Electrical drive in the speed-torque plane and sketch the directions of speed, load torque and motor torque.	(16)	BTL 4	Analyz	CO1
2	Figure below shows the speed-torque curves of the motor and load in the four quadrants. Comment on the stability of the equi1ibrium points A, B, C, and D. 	(16)	BTL 4	Analyz	CO1
3	Figure below shows plots of speed vs motor and load torques. Comment on the stability of the operating points A, B, C, and D.	(16)	BTL 4	Analyz	CO1

					
4	Explain in detail the multi quadrant operation of low Speed hoist in speed torque plane.	(16)	BTL 4	Analyz	CO1
5	Figure below shows the speed-torque curves of the motor and load. Comment the stability of a, b, c, d, e, f and g. 	(16)	BTL 4	Analyz	CO1
6	Demonstrate the use of different electrical braking methods in the operation of a low-speed hoist.	(16)	BTL 3	Apply	CO1
7	Illustrate the essential parts of an electric drive and explain the function of each part.	(16)	BTL 3	Apply	CO1
8	Apply the concept of speed–torque characteristics to explain various types of loads with suitable	(16)	BTL 3	Apply	CO1

	diagrams.				
9	Discuss in detail the four quadrant dynamics in the speed–torque plane.	(16)	BTL 4	Analyz	CO1
10	Define in detail about the braking of DC drives and AC Drives.	(16)			CO1
11	Analyze the different modes of operation of an electrical drive.	(16)	BTL 4	Analyze	CO1
12	Solve a motor drives two loads. One has rotational Motion. It is coupled to the motor through a reduction gear with a = 0.1 and efficiency of 90%. The load has a moment of inertia of 10 kg-m^2 and a torque of 10 N-m. Other load has translational motion and consists of 1000kg weight to be lifted up at a uniform speed of 1.5 m/s. coupling between this load and the motor has an efficiency of 85%. Motor has inertia of 0.2 kg-m^2 and runs at a constant speed of 1420 rpm. Determine equivalent inertia referred to the motor shaft and power developed by the motor.	(16)	BTL 5	Evaluate	CO1
13	Compose the mathematical condition to obtain steady State stability of equilibrium point.	(16)	BTL 3	Apply	CO1
14	Explain the operation of electrical drives in three Different modes.	(16)	BTL 3	Apply	CO1
15	llustrate the various forms of electrical drives and compare them using appropriate parameters.	(16)	BTL 3	Apply	CO1
16	Discuss with the suitable mathematical model, the Analysis of steady state stability of an electrical drive.	(16)	BTL 4	Analyze	CO1
17	List the possible forms of electrical drives and compare them.	(16)	BTL 3	Apply	CO1
18	Analyze the factors governing the selection of electric drives and explain the motor-load dynamic equations.	(16)	BTL 4	Analyze	CO1

UNIT-II - CONVERTER / CHOPPER FED DC MOTOR DRIVE

Steady state analysis of the single and three phase converter fed separately excited DC motor drive – Converter fed DC Self-Excited motor drive - continuous and discontinuous conduction– Time ratio and current limit control – 4 quadrant operations of converter / chopper fed drive- Effect of ripples on the DC motor performance – Applications of DC Drives.

PART-A

Q. No	Questions	BT Level	Competence	CO
1	List the drawbacks of AC–DC converter (rectifier) fed DC drives.	BTL 1	Remember	CO2

2	Is it possible to operate a semi-converter fed DC drive in quadrant IV?	BTL 1	Remember	CO2
3	Differentiate between continuous and discontinuous conduction mode.	BTL 1	Remember	CO2
4	State the necessity of DC choke coil and freewheeling diode in a converter circuit.	BTL 1	Remember	CO2
5	Write the speed–torque equation of a single-phase fully controlled converter fed separately excited DC motor.	BTL 1	Remember	CO2
6	Write the speed–torque equation of a three-phase fully controlled converter fed separately excited DC motor.	BTL 1	Remember	CO2
7	Define the speed control methods of a DC motor.	BTL 1	Remember	CO2
8	Can a semi-converter fed three-phase DC drive operate in quadrant IV?	BTL 1	Remember	CO2
9	State the operating principle of a three-phase fully controlled converter fed separately excited DC motor.	BTL 1	Remember	CO2
10	State the operating principle of a single-phase fully controlled converter fed separately excited DC motor.	BTL 1	Remember	CO2
11	When is discontinuous conduction expected in converter-fed DC drives?	BTL 1	Remember	CO2
12	State whether discontinuous conduction occurs in chopper-fed DC drives.	BTL 1	Remember	CO2
13	Illustrate the expression for the average output voltage of a full converter fed dc drive.	BTL 2	Understand	CO2
14	Illustrate the speed torque equation of dc separately excited motor fed drive.	BTL 2	Understand	CO2
15	Describe the advantages of chopper fed drive over converter fed drive.	BTL 2	Understand	CO2
16	Summarize the control strategies of chopper.	BTL 2	Understand	CO2
17	What are the advantages in operating choppers at h i g h Frequency?	BTL 2	Understand	CO2
18	Describe the advantages of chopper fed DC drive.	BTL 2	Understand	CO2
19	Discuss the Electrical and mechanical characteristics of separately excited dc motors.	BTL 2	Understand	CO2
20	What are the applications of chopper fed DC drives?	BTL 2	Understand	CO2
21	Illustrate the expression for the average output voltage of a three phase bridge converter fed dc drive.	BTL 2	Understand	CO2
22	Illustrate the expression for the motor speed of a single phase Full converter fed dc drive.	BTL 2	Understand	CO2
23	Define the duty cycle of chopper.	BTL 2	Understand	CO2
24	Illustrate the expression for the average output voltage and motor speed of a three phase Full converter fed dc drive.	BTL 2	Understand	CO2

	PART-B				
1	Explain the steady state analysis of the single phase fully Controlled converter fed separately excited DC motor Drive for continuous current mode. Also explain its operation in motoring and regenerative braking mode.	(16)	BTL 4	Analyze	CO2
2	Solve a 450V separately excited dc motor has an armature Resistance of 4.5Ω when driving a load at 600 r.p.m. with constant torque, the armature takes 40 A. This motor is controlled by a chopper circuit with a frequency of 400 Hz and an input voltage of 450 V. (i) What should be the value of the duty ratio if one desires to reduce the speed from 600 to 540 r.p.m. with the load torque maintained constant? (ii) Find out the value of duty ratio for which the per unit ripple current will be maximum.	(16)	BTL 5	Evaluate	CO2
3	Describe about Electrical –mechanical characteristics of Commonly used electric motors.	(16)	BTL 4	Analyze	CO2
4	Describe the steady state analysis of the single phase fully Controlled converter fed separately excited DC motor drive for continuous and discontinuous conduction mode.	(16)	BTL 4	Analyze	CO2
5	Analyze the steady state analysis of single phase converter Fed DC motor drive for continuous mode of conduction.	(16)	BTL 4	Analyze	CO2
6	(i) Define in detail about the regenerative operation of three phase fully controlled rectifier control of separately excited DC motor. (8) (ii) Define in detail about the four quadrant operation of chopper fed drive. (8)	(16)	BTL 4	Analyze	CO2
7	Compose the operation of single phase controlled converter Fed separately excited DC motor in continuous and Discontinuous modes with neat diagram, waveforms and Comment the steady state analysis	(16)	BTL 3	Apply	CO2

8	Explain the four quadrant operation of chopper fed DC Separately excited motor drive with necessary diagram.	(16)	BTL 3	Apply	CO2
9	Explain in detail about the operation of single phase fully-Controlled converter fed dc separately excited motor in Continuous and discontinuous conduction modes of operation with Necessary waveforms and steady state analysis.	(16)	BTL 4	Analyze	CO2
10	(i) Discuss the different control techniques of chopper in Detail. (8) (ii) Discuss the four quadrant operation of DC-DC converter. (8)	(16)	BTL 4	Analyze	CO2
11	(i) Explain the operation of four quadrant dc chopper drive. (6) (ii)Solve a 440 V, 40A, 1000 rpm separately excited dc motor has an armature resistance of 4.5 Ω. The motor is controlled by a step-down chopper with a frequency of 1 kHz. The input dc voltage to the chopper is 450V. Identify what will be the duty cycle of the chopper for the motor to operate at a speed of 600 rpm delivering the rated torque. (10)	(16)	BTL 4	Analyze	CO2
12	Discuss in detail the four-quadrant operation of chopper fed DC Drive,	(16)	BTL 3	Apply	CO2
13	(i) Describe how regenerative braking is obtained in series Motor with chopper control. (8) (ii) List the uses of phase controlled rectifiers in DC drives. (8)	(16)	BTL 3	Apply	CO2
14	Explain the ward – Leonard scheme of speed control of dc motor.	(16)			CO2
15	Compare the single phase full converter and three phase bridge converter fed dc motor drives.	(16)	BTL 3	Apply	CO2
16	Discuss the operation of a three phase dual converter fed separately excited dc motor drive.	(16)	BTL 4	Analyze	CO2
17	Draw and explain the operation of a single phase dual converter fed separately excited dc motor drive.	(16)	BTL 4	Analyze	CO2

UNIT-III - INDUCTION MOTOR DRIVES

Stator voltage control–energy efficient drive–v/f control–constant air gap flux–field weakening mode– Voltage / current fed inverter – closed loop control-slip power recovery scheme- vector control - Applications of Induction motor Drives.

PART-A

Q. No	Questions	BT Level	Competence	CO
1	Justify Why stator voltage control is suitable for speed Control of induction motors in fan and pump drives.	BTL 2	Understand	CO3
2	Summarize different methods of braking applied to induction motor.	BTL 2	Understand	CO3
3	What are the advantages of induction motor over DC Motor	BTL 3	Analyze	CO3
4	Discuss different methods of speed control of induction motor.	BTL 1	Understand	CO3
5	Tell the drawbacks of stator voltage controlled Induction Motor drive.	BTL 1	Remember	CO3
6	Define three regions in speed vs torque characteristics of induction motor.	BTL 1	Remember	CO3
7	List any two applications of ac drives.	BTL 1	Remember	CO3
8	Show the various applications of rotor resistance control.	BTL 3	Apply	CO3
9	Explain the soft start.	BTL 3	Apply	CO3
10	Discuss stator voltage control method.	BTL 2	Understand	CO3
11	What do you mean by field weakening mode control?	BTL 1	Remember	CO3
12	Compare CSI fed drives and VSI fed drives	BTL 1	Remember	CO3
13	Discuss the advantages of PI controller used in closed loop control of induction motor drives.	BTL 1	Remember	CO3
14	Compose the merits and demerits of voltage fed inverters ontrolled drives.	BTL 2	Understand	CO3
15	Give the advantages of vector control method.	BTL 2	Understand	CO3
16	What are the drawbacks of ward-Leonard system?	BTL 2	Understand	CO3
17	Write any two advantages of closed loop control system.	BTL 1	Remember	CO3
18	Illustrate features from which slip controlled drive is developed.	BTL 1	Remember	CO3
19	Discuss the slip controlled device.	BTL 1	Remember	CO3
20	What are the applications of vector control method?	BTL 2	Understand	CO3
21	List the scherbius systems of speed control methods,	BTL 2	Understand	CO3

22	Give the applications of Kramer electrical drive.		BTL 2	Understand	CO3
23	List the advantages of v/f speed control of induction motor.		BTL 1	Remember	CO3
24	Illustrate the different speed control techniques employed for ccontrolling the speed of an induction motor.		BTL 2	Understand	CO3
	PART-B				
1	Discuss in detail with suitable diagrams and waveforms of the v/f control technique of speed control method of Induction motor.	(16)	BTL 4	Analyze	CO3
2	Discuss Why a cyclo-converter fed induction motor drive is preferred over inverter controlled synchronous motor drive for low speed applications.	(16)	BTL 5	Evaluate	CO3
3	Explain the four modes of operation of a Static Scherbius drive with diagram.	(16)	BTL 4	Analyze	CO3
4	Analyze the operation of Voltage source inverter fed Induction motor drives.	(16)	BTL 4	Analyze	CO3
5	Describe the closed loop control of speed of induction motor drive fed by current source Inverter.	(16)	BTL 4	Analyze	CO3
6	Discuss various types of the speed control scheme of induction motor drive.	(16)	BTL 4	Analyze	CO3
7	Explain the closed loop control of static scherbius system of speed control with four possible modes of operation.	(16)	BTL 3	Apply	CO3
8	Show and explain with a neat diagram the field weakening mode control of induction motor drives.	(16)	BTL 3	Apply	CO3
9	Define in detail about the principle of vector control of Induction motor drive.	(16)	BTL 4	Analyze	CO3
10	Discuss the static Kramer drive system of speed control of an induction motor.	(16)	BTL 4	Analyze	CO3
11	Describe the closed loop speed control of VSI fed and CSI fed induction motor drives.	(16)	BTL 4	Analyze	CO3
12	Compose in detail about the closed loop operation of Armature voltage control method with field weakening mode control in detail.	(16)	BTL 3	Apply	CO3
13	(i) Describe the VSI fed induction motor	(16)	BTL 3	Apply	CO3

	drive. (8) (ii) What are the drawbacks of Stator Voltage Control Method? (8)				
14	Explain in detail about the vector control for a three phase induction motor.	(16)			CO3
15	A three phase 50Hz Induction motor has the following Parameters for its equivalent circuit R1 = R4 = 0.04 ohm and X1 = X4 = 0.1 ohm is to be operated at one half of its rated voltage and 45 Hz frequency. Calculate (i) the maximum torque at this reduced voltage and frequency operation in terms of its normal value and (ii) the starting torque at this reduced frequency and the voltage in terms of its normal value.	(16)	BTL 3	Apply	CO3
16	(i) Explain the operation of constant slip speed control. (8) (ii) Explain the stator voltage control scheme for speed control of three phase induction motor.(8)	(16)	BTL 4	Analyze	CO3
17	(i) Describe the VSI fed induction motor drives. (8) (ii) Describe the CSI fed induction motor drives. (8)	(16)	BTL 4	Analyze	CO3

UNIT-IV - SYNCHRONOUS MOTOR DRIVES

V/f control and self-control of synchronous motor: Margin angle control and power factor control- Three phase voltage/current source fed synchronous motor- Applications. Effects of Harmonics – Application of Synchronous motor Drives.

PART-A

Q. No	Questions	BT Level	Competence	CO
1	Justify why a self controlled synchronous motor is free from hunting oscillations?	BTL 2	Understand	CO4
2	Discuss why v/f ratio is kept constant up to base speed and V constant above base speed in variable frequency control.	BTL 2	Understand	CO4
3	Explain self control of synchronous motor.	BTL 3	Analyze	CO4
4	List any two applications of synchronous motor drives.	BTL 1	Understand	CO4
5	Compose the merits and demerits of PMSM	BTL 1	Remember	CO4
6	Illustrate when a synchronous motor said to be self	BTL 1	Remember	CO4

	controlled?				
7	Show the necessity of delay unit in an open loop v/f control of synchronous motor.		BTL 1	Remember	CO4
8	Why is damper winding absent in self controlled Synchronous motors?		BTL 3	Apply	CO4
9	Explain the modes of adjustable frequency control in synchronous motor drives.		BTL 3	Apply	CO4
10	Explain when a synchronous motor can be load commutated.		BTL 2	Understand	CO4
11	What are the different types of controls used in Synchronous motor drives?		BTL 1	Remember	CO4
12	Formulate the expression for torque equation of salient pole synchronous motor.		BTL 1	Remember	CO4
13	Define torque angle		BTL 1	Remember	CO4
14	What is slip power recovery scheme?		BTL 2	Understand	CO4
15	Name the two controllers employed in the closed loop control of synchronous motor drives.		BTL 2	Understand	CO4
16	Discuss the disadvantages of load commutation in the CSI fed synchronous motor drive.		BTL 2	Understand	CO4
17	What are the types and advantages of permanent magnet AC synchronous motor drives?		BTL 1	Remember	CO4
18	List the merits and demerits of VSI fed synchronous motor drives.		BTL 1	Remember	CO4
19	Define margin angle control of synchronous motor drive.		BTL 1	Remember	CO4
20	What is meant by super synchronous operation?		BTL 2	Understand	CO4
21	Define the power factor control of synchronous motor drive.		BTL 2	Understand	CO4
22	List the different harmonics injected to ac system when 6 pulse converter is used to control the speed of synchronous		BTL 2	Understand	CO4
23	Discuss the basic principle of synchronous motor.		BTL 1	Remember	CO4
24	Explain synchronous reluctance motor.		BTL 2	Understand	CO4
	PART-B				
1	Explain the forward motoring and braking operation of open loop V/f control of multiple PMSM with relevant phasor diagram.	(16)	BTL 4	Analyze	CO4
2	(i) Discuss using a block diagram the operation	(16)	BTL 5	Evaluate	CO4

	of a voltage source inverter fed synchronous motor in the true Synchronous mode. (8) (ii) Explain the self-control of Synchronous motor in detail. (8)				
3	Compare in detail V/F control strategies of induction motor and synchronous motor drive.	(16)	BTL 4	Analyze	CO4
4	Discuss in detail with help of block diagram the closed loop control load commutated inverter fed synchronous motor drive.	(16)	BTL 4	Analyze	CO4
5	Explain the margin angle control and power factor control of synchronous motor drives.	(16)	BTL 4	Analyze	CO4
6	Explain the constant marginal angle control technique of self controlled synchronous motor drive employing load commutated thyristor inverter.	(16)	BTL 4	Analyze	CO4
7	Compose the closed loop control of synchronous motor with neat block diagram	(16)	BTL 3	Apply	CO4
8	Describe using a diagram the working of a voltage source inverter fed synchronous motor Drive.	(16)	BTL 3	Apply	CO4
9	Explain using a circuit and phasor diagram how the speed of a synchronous motor is controlled in the true synchronous mode.	(16)	BTL 4	Analyze	CO4
10	Describe briefly the power factor angle control of synchronous motors with relevant vector diagram.	(16)	BTL 4	Analyze	CO4
11	Describe the closed loop operation of permanent magnet synchronous motor drive in details.	(16)	BTL 4	Analyze	CO4
12	Discuss in detail the construction, Principle of operation and application of permanent magnet synchronous motor.	(16)	BTL 3	Apply	CO4
13	Discuss the Various application of three phase voltage source inverter fed synchronous motor drive.	(16)	BTL 3	Apply	CO4
14	(i) Discuss briefly separate controlled mode of synchronous motor in detail. (8) (ii) Explain self control of synchronous motor drive in detail. (8)	(16)			CO4
15	Explain margin angle control of synchronous motor drive.	(16)	BTL 3	Apply	CO4

16	A 8 MW, 3 phase , 15 KV star connected 6 pole, 0.9 leading power factor synchronous motor has Xs equal to 10 ohms and Rs equal to zero. The rated field current is 65 Amps. The motor is controlled by variable frequency control at constant V/f ratio upto base speed and at constant V above base speed. Identify the torque and field current for rated armature current, 750 rpm and 0.8 leading power factor.	(16)	BTL 4	Analyze	CO4
17	Explain margin angle control of synchronous motor drive.	(16)	BTL 4	Analyze	CO4

UNIT-V - DESIGN OF CONTROLLERS FOR DRIVES

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode –Design of Controllers; current controller and speed controller- converter selection and characteristics.

PART-A

Q. No	Questions	BT Level	Competence	CO
1	Discuss the roles of inner current control and outer speed control loops?	BTL 2	Understand	CO5
2	List the methods of speed sensing.	BTL 2	Understand	CO5
3	Write down the transfer function expression of converter.	BTL 3	Analyze	CO5
4	Give the advantages of Pi controller.	BTL 1	Understand	CO5
5	Describe field weakening mode control.	BTL 1	Remember	CO5
6	Name any four simulation software packages that can be used for electrical drives.	BTL 1	Remember	CO5
7	Give the real and reactive power equations of a balance 5 phase ac system.	BTL 1	Remember	CO5
8	List the advantages of closed loop speed control.	BTL 3	Apply	CO5
9	Discuss the role of current limiter in the closed loop control of DC drives.	BTL 3	Apply	CO5
10	When can a synchronous motor be load commutated?	BTL 2	Understand	CO5
11	Name any four simulation packages that can be used for electrical drives	BTL 1	Remember	CO5
12	Show the transfer function of DC motor load system.	BTL 1	Remember	CO5
13	Show the mechanical and electrical time constant of DC machines.	BTL 1	Remember	CO5
14	Explain how speed feedback achieved in speed controller design?	BTL 2	Understand	CO5

15	Explain armature voltage control.		BTL 2	Understand	CO5
16	What are the modes of adjustable frequency control in synchronous motor drives?		BTL 2	Understand	CO5
17	Draw and label the basic block diagram of closed loop control system.		BTL 1	Remember	CO5
18	What is the design procedure for a closed loop speed control system?		BTL 1	Remember	CO5
19	Write the transfer function expression for speed controller.		BTL 1	Remember	CO5
20	Compose the disadvantages of phase controlled converter fed DC motor drives.		BTL 2	Understand	CO5
21	Give the transfer function relating speed and armature current of a dc motor.		BTL 2	Understand	CO5
22	List the functions of feedback loops in an electrical drive.		BTL 2	Understand	CO5
23	Give the factors to be considered for the selection of controller.		BTL 1	Remember	CO5
24	List the factors controlling the speed of dc motor.		BTL 2	Understand	CO5
	PART-B				
1	Design a current controller for small capacity constant speed drive.	(16)	BTL 4	Analyze	CO5
2	Explain the design procedure and derive the transfer function of the Speed and Current controller.	(16)	BTL 5	Evaluate	CO5
3	Summarize the factors involved in converter selection and equations involved in controller characteristics.	(16)	BTL 4	Analyze	CO5
4	Derive the transfer function of DC motor load system with Converter fed system.	(16)	BTL 4	Analyze	CO5
5	Explain in detail the design of speed controller of closed loop speed control system of separately excited dc motor.	(16)	BTL 4	Analyze	CO5
6	Derive the transfer function of separately excited dc motor with armature voltage control.	(16)	BTL 4	Analyze	CO5
7	Design the speed controller of converter fed separately excited dc motor with inner current control and outer speed control loops.	(16)	BTL 3	Apply	CO5
8	Design a current controller for a small capacity constant speed drive.	(16)	BTL 3	Apply	CO5

9	Explain the step by step procedure of design of speed controller for closed loop control of separately excited de motor with armature voltage control.	(16)	BTL 4	Analyze	CO5
10	Explain the design procedure and derive the transfer function of the current controller.	(16)	BTL 4	Analyze	CO5
11	Derive and explain from basic principles the transfer function for separately excited DC motor load system with converter fed armature voltage control.	(16)	BTL 4	Analyze	
12	Explain the closed loop operation of armature voltage control method and field weakening mode control for DC drive.	(16)	BTL 3	Apply	CO5
13	Give the design procedure for speed controller of electrical drive system with necessary diagrams.	(16)	BTL 3	Apply	CO5
14	Discuss the use of simulation software package for design of controller for drives.	(16)			CO5
15	List the factors involved in converter selection and equations involved in controller characteristics.	(16)	BTL 3	Apply	CO5
16	Using suitable block diagram explain the following control (i)Current limit control (ii) Closed loop torque control (iii) Closed loop speed control. (6+5+5)	(16)	BTL 4	Analyze	CO5
17	(i) Derive the transfer function of DC Motor-load system with armature voltage control. (8) (ii) How do you select the rating of the converter based on the drive application? (8)	(16)	BTL 4	Analyze	CO5

Course Outcome:

At the end of this course, learners will be able to:

- Analyze the steady-state operating characteristics and evaluate the transient dynamics of motor load systems under different operating conditions.
- Explain and analyze the operation of converter-fed and chopper-fed DC drives using both qualitative descriptions and quantitative models.
- Analyze and evaluate the operation, control strategies, and performance characteristics of AC motor drive systems.
- Design and analyze current and speed controllers for a closed-loop solid-state DC motor drive to meet desired performance specifications.
- Analyze and assess the operating principles, control methods, and performance of synchronous motor drive systems.