UNIT WISE QUESTION BANK

Sub: Power Semiconductor Drives Year: IV B. Tech I Sem

Unit-1

S. No	Questions
1.	Derive an expression relating speed and torque of a single phase full converter fed separately excited DC motor drive operating in the continuous current mode
2.	Analyze and describe the operation of single phase fully controlled rectifier control of DC series motor and obtain the expression for motor speed for continuous mode of operation
3.	Explain the use of freewheeling diode in the converter fed DC drives. Take an example of 1-phase fully controlled converter fed for explanation. How it is going to affect the Machine performance.
4.	Describe the operation of single phase semi controlled rectifier control of DC series motor and obtain the expression for motor speed for continuous mode of operation
5.	Derive an expression for an average output voltage of a 1-phasesemi-converter.Assumingaveryhighlyinductiveload,drawthewaveformsofoutputvoltage,loadcurrentand voltage across thyristors
6.	Explain the operation of three phase full controlled rectifier fed dc series motor drives with waveforms and characteristics
7.	Compare three phase drives and single phase drives
8.	A single phase fully controlled thyristor converter is supplying a DC separately excited DC motor. Draw the neat waveforms diagrams and explain various operating modes of the drive Both in motoring and regenerative braking for (a) $\gamma < \alpha$ (b) $\gamma > \alpha$ Where α is the firing angle, γ is the angle at which the source voltage equal to the motor back emf. Assume the armature of the separately excited dc motor can be replaced by simple R-Land back emf load
9.	List the applications of electrical drives
10.	What are the advantages of three phase controlled converter fed DC Drives

Unit-2

S. No	Questions
1.	What is4-quadrant operation and explain with converters.
2.	What is a dual converter? Explain the principle of operation of a dual converter in a circulating current mode. How the same is used for speed control of DC drive
3.	Explain how four-quadrant operation is achieved by dual converter each of 1ϕ full wave configuration for DC separately excited motor.
4.	Explain the principle of closed-loop control of a DC drive using suitable block diagram.
5.	Draw and explain the torque-speed characteristics for dynamic braking operation of DC series motor. Why torque becomes zero at finite speed
6.	Explain the different types of control strategies of DC chopper.
7.	With a neat diagram, explain the operation of a DC drive in all four quadrants when fed by a single phase dual converter with necessary waveforms and characteristics.
8.	Draw the circuit diagram and explain the operation of closed loop speed control with inner-current loop and field weakening
9.	List types of control strategies of Dc chopper?
10.	ElectricalbrakingofseriesmotorisnotstraightforwardasthatofaseparatelyexcitedDCmotors–Justify

Unit-3

S. No	Questions
1.	Why stator voltage control is an inefficient method of induction motor speed

	control
2.	Draw a closed loop block diagram for the above speed control technique. Mention the merits of the above method of speed control
3.	Explain the mechanical characteristics of at hree phase induction motor with stator frequency control.
4.	Explain in detail the speed control scheme for a three phase induction motor using PWM inverter.
5.	Constant torque loads are not suitable for AC voltage controller fed induction motor drive. Why?
6.	Explain in detail the voltage source inverter control of induction motor drive.
7.	Explain the closed-loop speed control and converter rating for VSI and cyclo converter induction motor drives.
8.	A Y-connected squirrel-cage induction motor has following rating parameters: 400V, 50Hz, 4-pole, 1370rpm, R_S2 ohm, R'3 ohm, XX'3.5 ohm, Motor is controlled by a voltage source inverter at constant V/f ratio. Inverter allows frequency variation from 10 to 50Hz. (i) Obtain a plot between the breakdown torque and frequency. (ii) Calculate starting torque and current of this drive as a ratio of their values when motor is started at rated voltage and frequency.
9.	A 440V, 3 phase, 50Hz 6 pole 945 RPM delta connected induction motor has the following parameters referred to the stator. R1=2.0 Ω, R2 = 2.0Ω, X1 = 3 Ω, X2 = 4 Ω. When driving a fan load at rated voltage, it runs at rated speed. The motor speed is controlled by stator voltage control. Determine motor terminal voltage, current and torque at 600 RPM.
10.	Explain in detail with speed-torque characteristics of variable voltage and variable frequency (V/F) control of induction motor drive

Unit-4

S.No	**Questions**
1.	With the help of a neat schematic, discuss the operation of a Static Scherbius drive. Derive the speed-torque expression and draw its speed-torque characteristics.
2.	With the help of a neat schematic discuss the operation of a Static Kramer drive.

3.	Draw the speed-torque characteristics of induction motor with variable rotor resistance and explain why this method is inefficient.
4.	With the help of a neat schematic discuss the operation of a Static rotor resistance control method for induction motor speed control.
5.	440 V, 50 Hz, 6-pole Y-connected wound rotor motor has the following parameters: Rs = 0.5 Ω, Rr' = 0.4 Ω, Xs = Xr' = 1.2 Ω, Xm =50 Ω, stator to rotor turns ratio is 3.5. Motor is controlled by static rotor resistance control. External resistance is chosen such that the breakdown torque is produced at standstill for a duty ratio of zero. Calculate the value of external resistance.
6.	A three phase, 400V, 6-pole, 50 Hz, delta connected slip ring induction motor has rotor resistance of 0.2 ohms and leakage reactance of 1 ohms per phase referred to stator. When driving a fan load it runs at full load of 4% slip. What resistance must be inserted in the rotor circuit to obtain a speed of 850rpm. Neglect stator impedance and magnetizing branch. Stator to rotor turns ratio is 2.2.
7.	A 400V, 50 Hz, 950rpm, 6-pole, star connected, three phase wound rotor induction motor has following parameters referred to the stator: Rs = 0.2 Ω, Rr' = 0. 07Ω, Xs = 0.4 Ω, Xr' = 0.4 Ω, the stator to rotor turns ratio n is 2. Motor speed is controlled by static scherbius drive. Drive is designed for a speed range of 25% below the synchronous speed. Maximum value of firing angle is150^{o}.Calculate (i) Turns ratio of transformer (ii)Torque for a speed of 750 rpm and α=130^{o}.
8.	A 440V, 50 Hz, 970rpm, 6-pole, star connected, three phase wound rotor induction motor has following parameters referred to the stator: Rs = 0.1 Ω, Rr' = 0.08Ω,Xs=0.3Ω,Xr'=0.4 Ω, the stator to rotor turns ratio n is 2. Motor speed is controlled by static scherbius drive. Drive is designed for a speed range of 25% below the synchronous speed. Maximum value of firing angle is165^{o}.Calculate (i) Turns ratio of transformer. (ii)Torque for a speed of 780 rpm and α=140^{o}.
9.	Explain the speed control and performance characteristics of static Kramer's drive.

10.	Describe the static rotor resistance control for speed control of an induction motor.

Unit-5

S.No	Questions
1.	What is the difference between true synchronous mode and self control mode for variable frequency control of synchronous motor?
2.	Explain closed loop control operation of a synchronous motor drive.
3.	Explain the operation of self-controlled synchronous motor drive using VSI.
4.	Explain how operation of a synchronous motor shifts from motoring to regenerative braking.
5.	A400kW,three-phase,3.3kV,50Hz,unitypowerfactor, four-pole, star-connected synchronous motor has the following parameters: Ra=0, Xs= 12Ω, rated field current =10A. (i) The machine is controlled by variable frequency control at a constant V/f ratio. Calculate: The torque and field current for rated armature current, 900 rpm and 0.8 leading power factor, and (ii) The armature current and power factor for regenerative braking torque equal to rated motor torque,900 rpm and rated field current.
6.	Describe the operation of self-controlled Synchronous Motor drives in detail.
7.	Explain closed loop speed control of synchronous motor drive fed from CSI.
8.	Describe the operation of separate controlled Synchronous Motor drives in detail.
9.	Draw the block diagram and explain the operation of Load commutated VSI fed Synchronous motor drive.
10.	Explain variable frequency speed control of synchronous motor.