



---

Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the Model answer scheme.
  - 2) The model answer and the answer written by candidate may vary but the examiner may try To assess the understanding level of the candidate.
  - 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
  - 4) While assessing figures, examiner may give credit for principal components indicated in the Figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any Equivalent figure drawn.
  - 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant Values may vary and there may be some difference in the candidate's answers and model answer.
  - 6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
  - 7) For programming language papers, credit may be given to any other program based on equivalent concept.
- 

**Q1.**

a) Attempt any **THREE** of the following:

12M

i. State four advantages of electric motor as prime mover.

Ans:

01M each

**Advantages of electric motor as prime mover: (Any 4)**

- Electric drive is more flexible.
- It is more economical.
- It is cleaner as there is no fuel, fumes.
- It occupies less space as compared to other forms of drives and is, therefore, very compact source of drive.
- Its operating characteristics can easily be modified.
- It can be remote controlled.
- It requires less maintenance.
- It is reliable source of drive.

ii. List different factors considered for selection of electric drives

Ans:

01M each



**Factors:- (Any 4)**

**1 Nature of electric supply:**

Whether A.C. or pure D.C. Or rectified A.C supply is to be utilized for motor.

**2. Nature of the drive:**

Whether motor is to be drive individual machines or a group of machines.

**3. Nature of load:**

Whether the load requires light or heavy starting torque. Whether load torque increases with speed or remains constant. Whether load has heavy inertia which may require long starting time.

**4. Electrical characteristics of motors:**

- i. Starting characteristic.
- ii. Running characteristic
- iii. Speed control.
- iv. Braking characteristics.

**5. Size and rating of motor:**

- i. Whether motor is to run continuously, intermittently, or on a variable load cycle.
- ii. Whether over load capacity and pull out torque are sufficient.

**6. Mechanical considerations:**

- i. Type of enclosures.
- ii. Type of bearings.
- iii. Transmission of drive.
- iv. Noise level.

**7. Cost:**

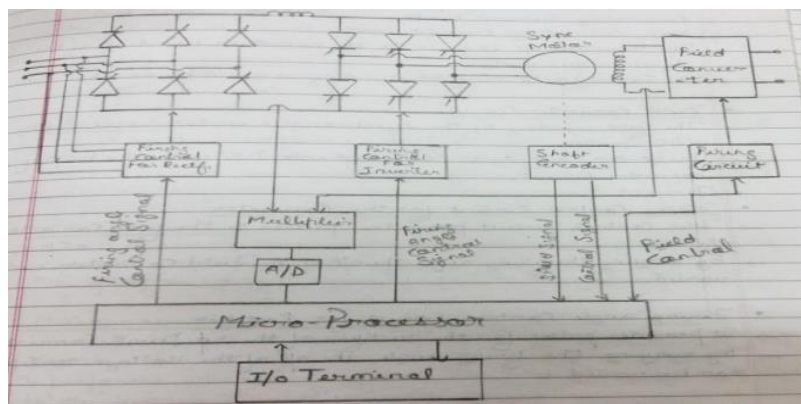
- i. Capital cost.
- ii. Running cost.

**iii. Draw block diagram of microcomputer based speed control of synchronous motor.**

Ans:

Diagram:-

4M



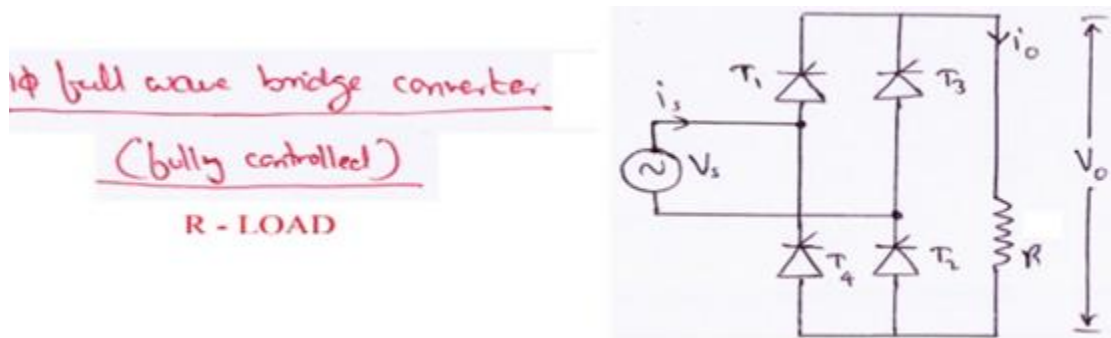


iv) Draw the circuit diagram of single phase full controlled bridge converter along with waveforms

Ans:

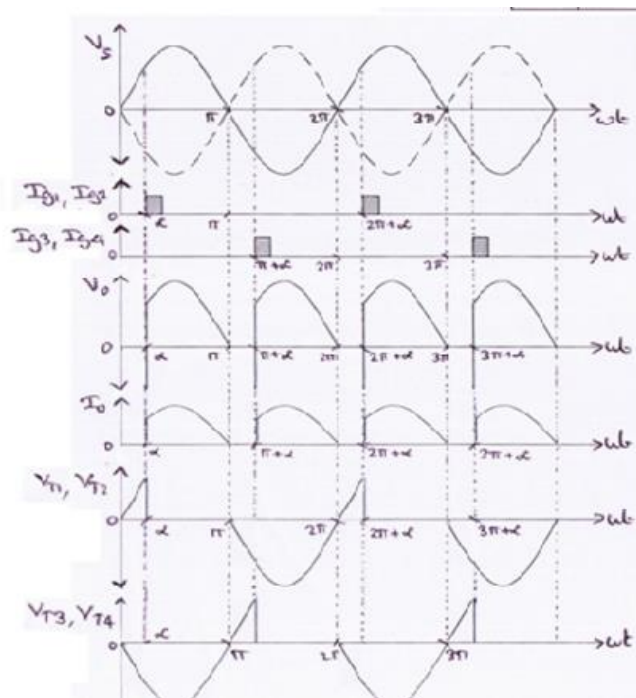
Diagram:-

02M



Wave form

02M



b) Attempt any ONE of the following:

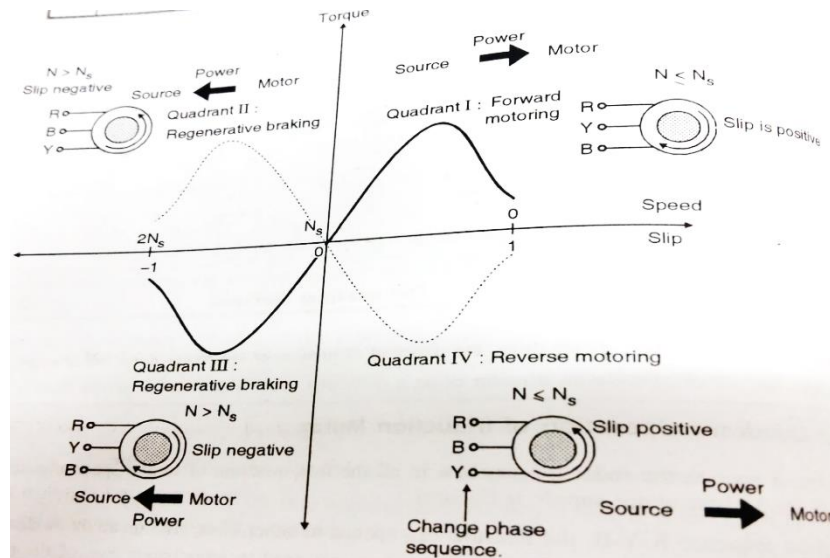
6M

i) Describe four quadrant operation of a drive with the help of speed-torque characteristics.

Ans:

Diagram:

03M



Explanation:

03M

- First quadrant operation-Forward motoring: Power is positive ie power flow is from source to load Motor rotates in clock wise direction. P
- Second quadrant operation-Forward Braking: Power is negative ie power flow is from load to source. Motor rotates in anti-clock wise direction.
- Third quadrant operation-Reverse motoring: Power is positive ie. power flow is from source to load. Motor rotates in clock wise direction.
- Fourth quadrant operation- Reverse braking. Power is negative ie power flow is from load to source. Motor rotates in anti- clock wise direction.

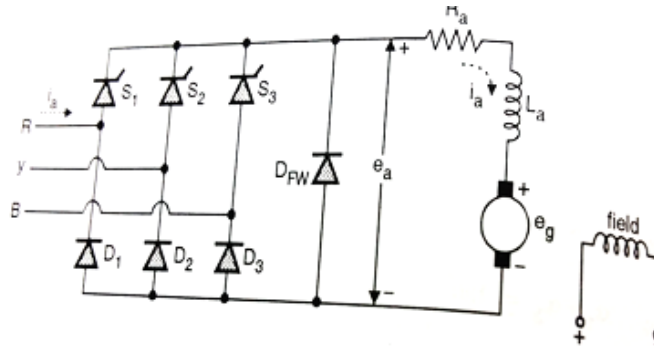


ii) With the help of neat diagram explain the operation of three phase semi-converter.

Ans:

Diagram

03M



Explanation:

03M

Three phase semi converter drive consist of 3 SCR's and 3 diodes. Load is inductive. Three phase semi converters are used in industrial applications up to 120 KW where a single quadrant operation is required. The power factor of 3 phase semi converter drive is better than 3 phase half wave converter drive.

- If S1 is fired at  $30^\circ + \alpha$ , S1 and D3 conduct, line voltage  $V_{ac}$  appears across the load. For the voltage  $V_{ba}$ , S2 and D1 conduct and for the voltage  $V_{cb}$ , S3 and D2 conduct.
- For firing angle  $> 90^\circ$ , waveform is discontinuous.
- Average dc output voltage is  $3\sqrt{3}V_m(1 + \cos \alpha) / (2\pi)$

Q2. Attempt any **FOUR** of the following:

16M

a) State four braking methods of an electric drive

Ans:-

Four braking methods of an electric drive (Any four )

01M each

- Plugging/Counter current braking
- Dynamic braking
- Regenerative braking
- Mechanical braking



b) List different requirement of motors used for machine-tool applications

Ans:-

The requirements of motors used for machine tools are: (Any four requirements)

01M each

- The motor must be reliable & low cost, requiring less maintenance.
- They must be capable of speed control.
- The acceleration & the motor should be sufficiently fast to avoid motor heating during starting.
- Some machine tools require very high speed of operation.
- Numerically controlled machine tools are being preferred to conventional machine tools.
- The requirements of the drive motor are fast response, wide range of speed control, low vibrations, better thermal capacity, low maintenance etc.
- Due to the simple, economical & robust construction, reliability & less maintenance, squirrel cage and converter fed induction motors are suitable for driving machine tools.

c) Describe working of two quadrant chopper drive with the help of circuit diagram and waveform

Ans:-

Type C chopper drive

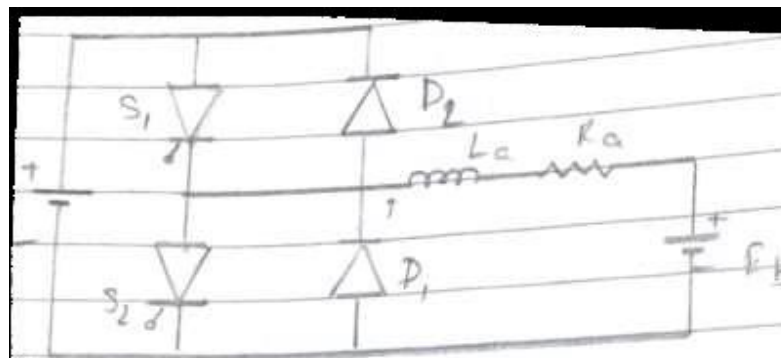
Explanation:

02M

**Type C chopper** is a two quadrant chopper drive. It is suitable for forward motoring and forward braking. The first quadrant is forward motoring and second quadrant is forward braking. It operates in First and second quadrant.

Circuit diagram:

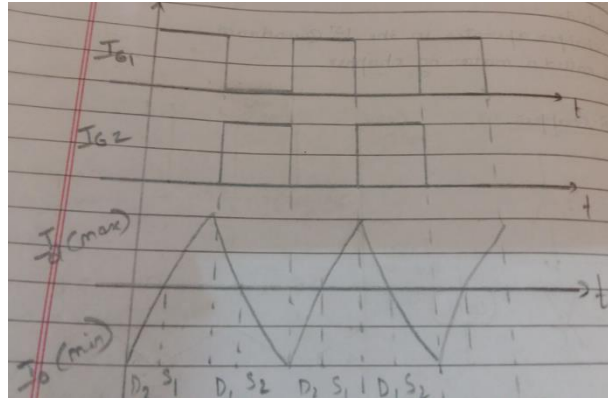
01M





Waveforms:

01M



OR

Type D chopper drive

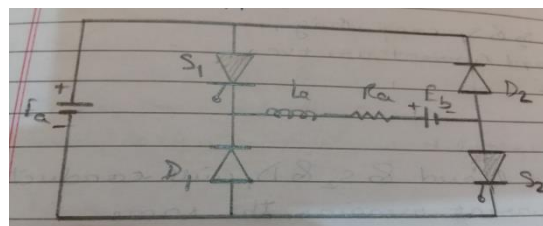
Explanation:

02M

**Type D chopper** is a two quadrant chopper drive. It is suitable for forward motoring and regenerative braking. The first quadrant is forward motoring and second quadrant is forward braking. It operates in First and fourth quadrant.

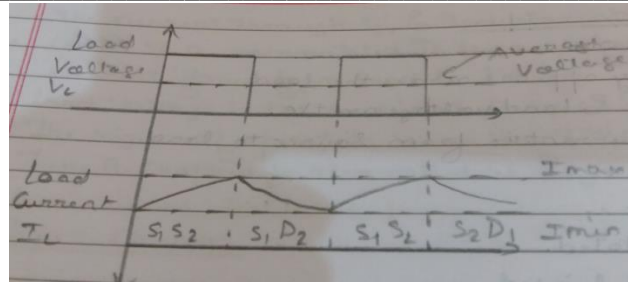
Circuit diagram:

01M



Waveforms:

01M



d) List any four advantage of converter fed induction motor.

Ans:-

01M each

Advantages of converter fed induction motor:- (Any 4)

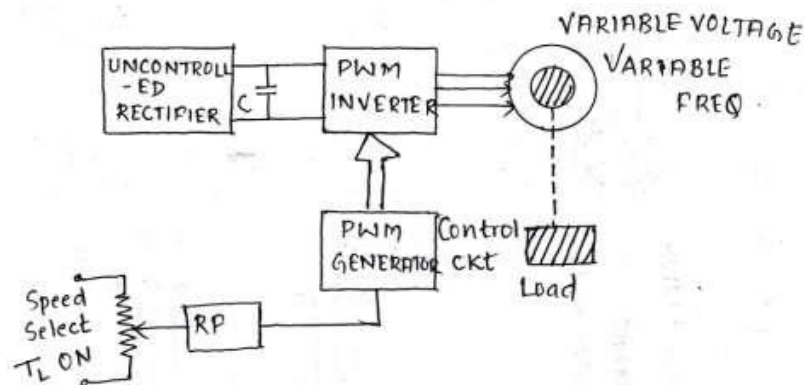
1. Smooth acceleration at constant current and torque can be obtained.
2. Smooth start-up can be achieved.
3. High moment of inertia can be accelerated.
4. Switching surges can be avoided.
5. Speed control method is easy.

e) Draw labeled block diagram of PWM controlled method of induction motor. List any two advantages

Ans:-

Diagram –

03 M



Advantages: (Any two)

1/2 each

- Torque pulsations are avoided.
- Losses are reduced.
- Lower order harmonics are completely eliminated.
- Input power factor is high.
- Filters need not be used.





f) What is the need of multi-phase chopper? Explain its working with circuit diagram.

Ans:

Need of multi-phase chopper:

01M

- The generated harmonics in the supply can be reduced.
- The size of the filter is reduced.
- The load current requirement can be increased.

Working:

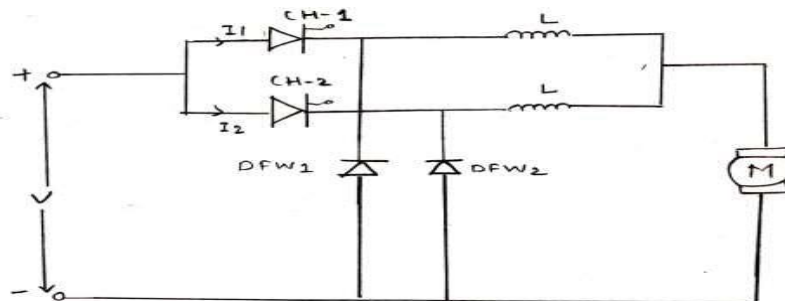
01M

It is a two chopper configuration. Chopper 1 and chopper 2 Class A choppers connected in parallel. DC motor is common load for chopper. Inductors L1 and L2 are connected in series with the motor load. There are two operating modes:

- In phase mode: In this mode both the choppers are turned ON and turned OFF simultaneously.
- Phase shift mode: In this mode both the choppers are turned ON at different instants of time.

Circuit diagram:

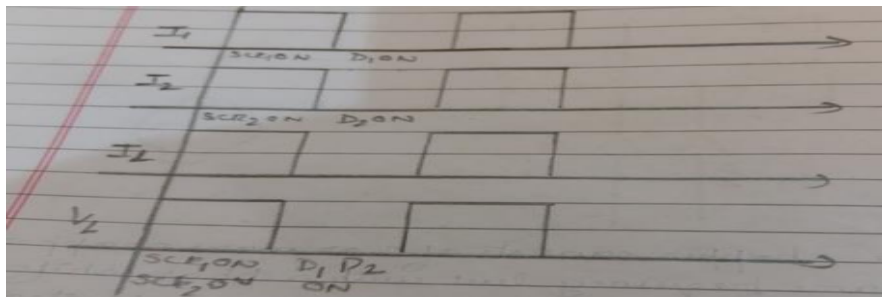
01M



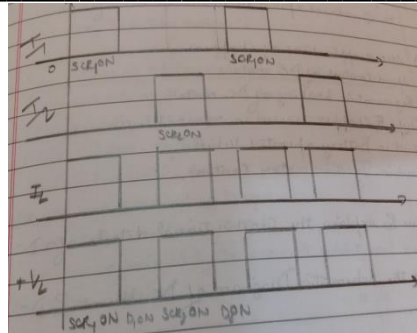
Waveforms:

01M

i) In-phase mode:



ii) Phase-shift mode:



Q3 Attempt any **FOUR** of the following:

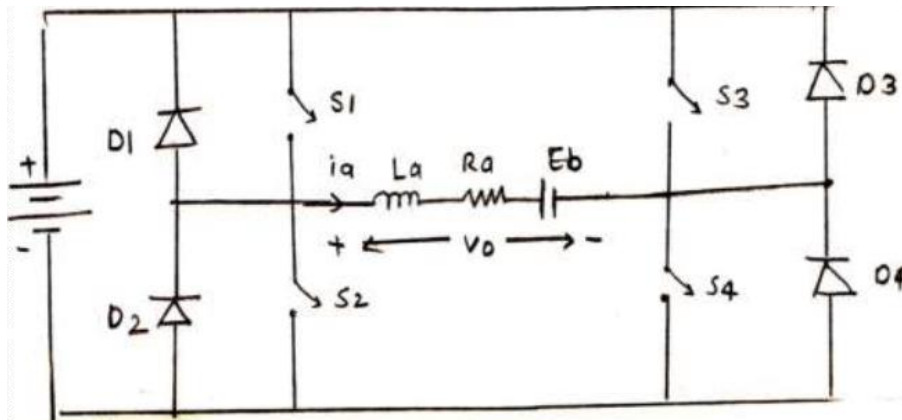
16M

a) Identify suitable type of chopper drive for reversible regenerative braking of DC drive. Justify with neat sketches.

Ans:

Diagram

02M



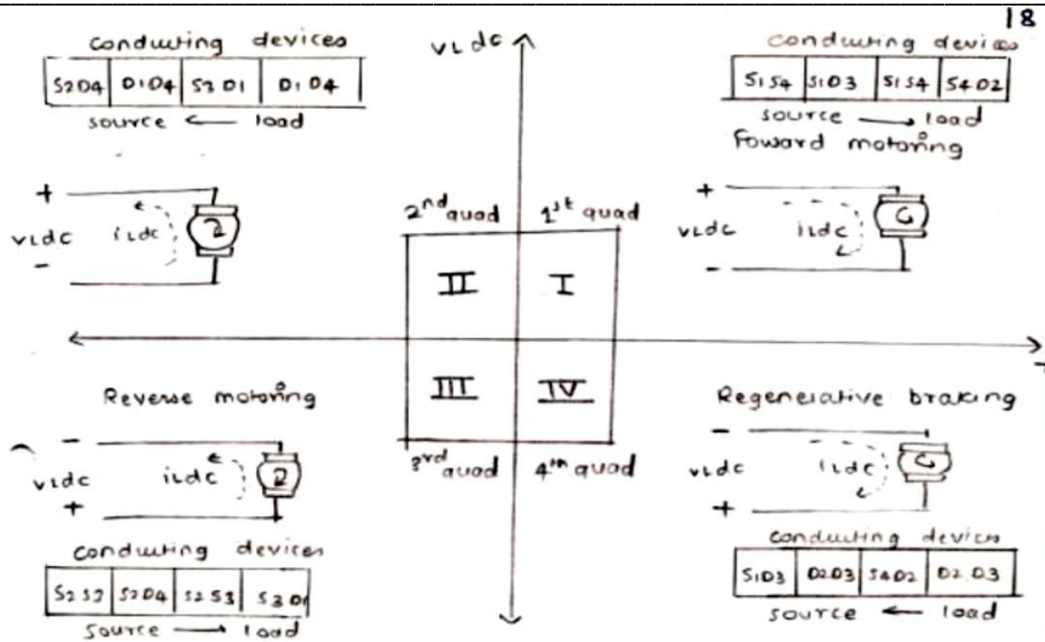


Fig. quadrant diagram for four quadrant chopper drive

Explanation:

02M

Type E-chopper :-

It is more suitable for reversible regenerative braking of DC drive because,

- We can control drive in all 4 quadrant & smoothly we can enter in to reversible regenerative braking mode of drive.
- Direction of rotation of the motor is possible.
- Regenerative braking in either direction is possible.
- Fast dynamic response.
- Closed loop control of motor is possible.

b) With the help of circuit diagram and waveform, explain the working of dc chopper using power MOSFET.

Ans:

Diagram:

01M

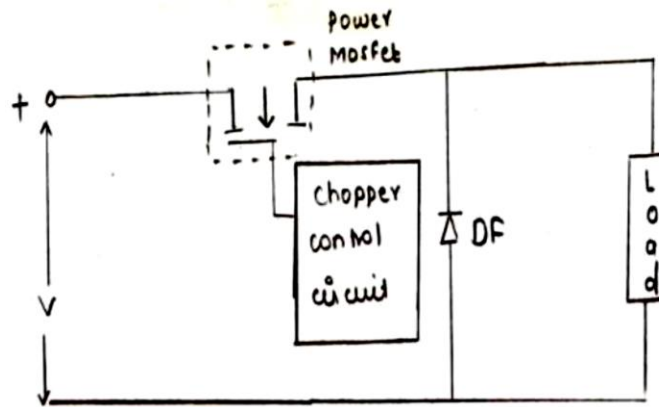


Fig. circuit diagram of DC chopper using power MOSFET

Waveform

01M

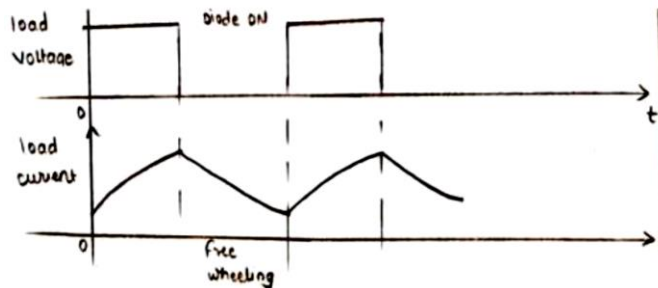


Fig. Voltage and current waveforms.

Explanation:

02M

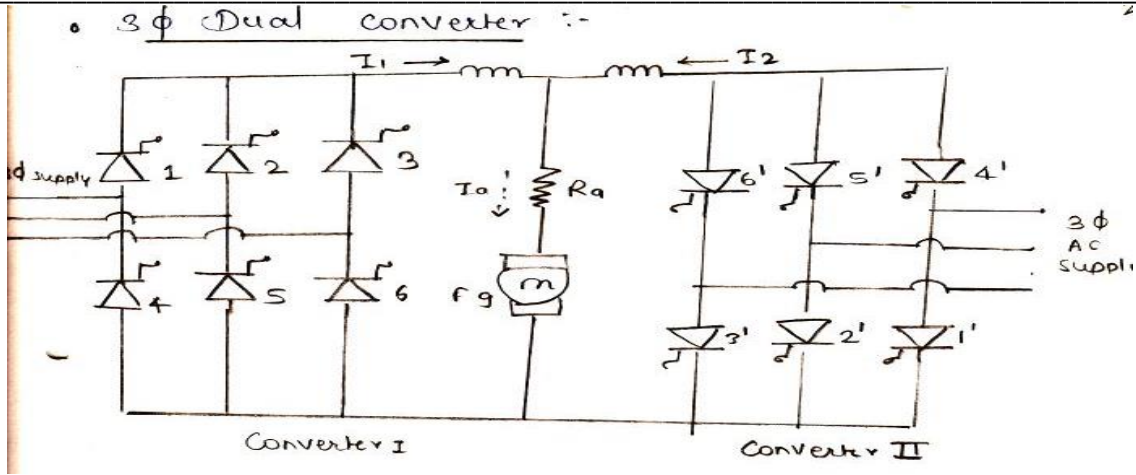
- The semi-conductor device used is power MOSFET. Load is inductive and free-wheeling diode is used.
- The gate control circuit provides rectangular voltage waveform.
- The duty cycle of the chopper can be controlled by varying this waveform. When the gate voltage is high, MOSFET is ON and acts like closed Switch.
- Load voltage is positive and load current rises exponentially and inductor stores energy. When the gate
- Voltage is zero, MOSFET is OFF and acts like open switch.
- Load voltage is zero and load current decays exponentially and stored energy in the inductor is dissipated.

c) Draw power circuit for 3 phase dual converter with neat labeled diagram . Give its application.

Ans:

Daigram:

02M



Power circuit for 3 phase dual converter

Application(Any two)

02M

Note: give marks for relevant applications

- Industrial Equipment's.
- Speed control of DC motor.
- Used in high power applications.

d) Compare Dc shunt and dc series motor with reference to its construction , characteristics and application.

Ans: (Construction 1 1/2 M, Characteristics 1 1/2 M , Application.1M)

Parameters	DC Shunt Motor	DC Series Motor
Construction	<p>In DC shunt Motor field winding is connected in parallel with the armature of the motor.</p>	<p>In DC series Motor field winding is connected in series with the armature of the motor.</p>



<p>Characteristics</p>	<p style="text-align: center;"><math>T \propto I_a</math></p>	<p style="text-align: center;"><math>\Phi \propto I_a</math></p>
<p>Application</p>	<p>Due to constant speed motor it is used for belt drive application, industrial and automotive applications.</p>	<p>Used in small electrical application, mobile electric equipment's and used in hoist.</p>

e) Compare AC drives and DC drives based on:

- i) Working
- ii) Type of motor
- iii) Power circuit used
- iv) Applications

Ans:

1M each

Parameter	AC Drive	DC Drive
1. Working	AC drive works on frequency.	DC drive works on voltage.
2. Type of motor	AC Motor.	DC Motor.
3. Power circuit used	Cyclo converter or inverter	AC to DC Converter or chopper.
4. Applications	Used in machine tool & traction application.	Used in traction, paper mill, Textile mill.



Q4

a) Attempt any THREE of the following:

12M

i) State importance of phase failure protection in 3phase drives.

Ans:-

Importance of phase failure protection in 3phase drives (Any 4)

1M each

The reasons for phase failure are:

- Blown fuse in some part of power distribution system
- Mechanical failure within the switching equipment
- Three phase induction motors running on 1phase draw all the current from the remaining two lines.
- Because of these reasons the motor will draw more current. This will cause heating of the motor and will damage the motor.
- Hence phase failure protection is required. Relays are used for protection.

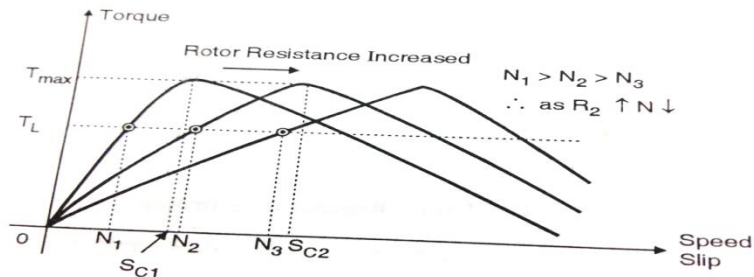
ii) Describe the effect of increasing rotor resistance in an induction motor with the help of speed torque

Characteristics

Ans:-

Characteristics:

2M



Explanation:

2M

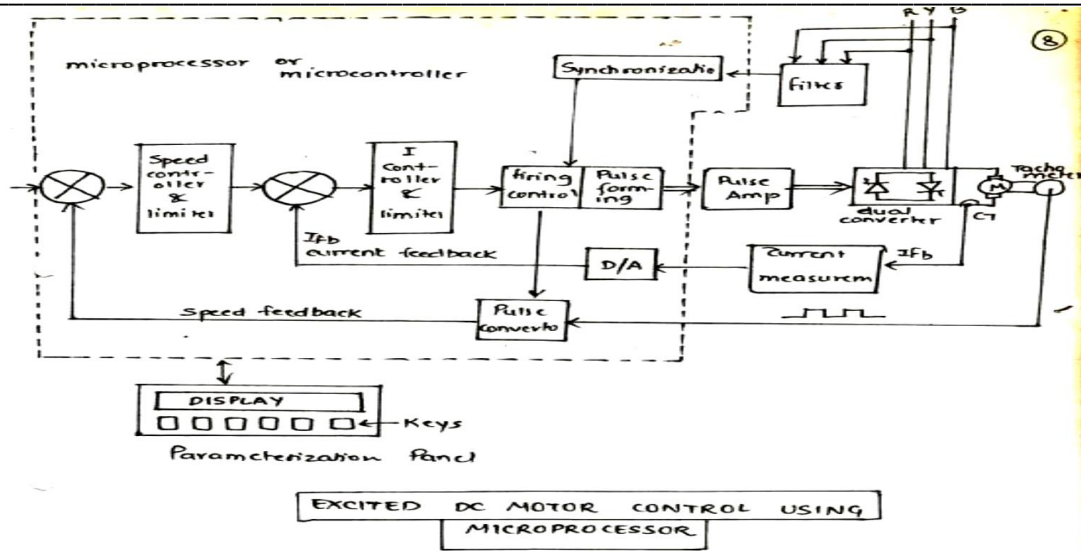
In a slip-ring induction motor, an external 3phase star connected rheostat is connected to the rotor of the motor. The speed of the motor can be varied by varying the resistance. As the rotor resistance increases, the speed decreases but the maximum torque remains the same.

iii) Describe the role of microprocessor for speed control of DC motor with neat block diagram.

Ans:-

Block diagram:

2M



**Role of micro-processor for speed control of drives: (Any four)**

2M

- Generating and providing firing pulses to the convertors.
- Generating of necessary waveforms to feed the motors.
- Processing the measured signal, such as voltage , current and speed.
- Storing and processing the information of controlled quantities.
- Identification and adaptation of variable parameters.
- Adaptive control and optimization
- General sequencing control
- Monitoring and warning
- Diagnostics and tests

**iv) List any four function performed by microprocessor in speed control of industrial drives**

Ans:-

**Functions of microprocessor in speed control of industrial drives:(any four points)**

1M each

- Generating and providing firing pulses to the convertors.
- Generating of necessary waveforms to feed the motors.
- Processing the measured signal, such as voltage , current and speed.
- Storing and processing the information of controlled quantities.
- Identification and adaptation of variable parameters.
- Adaptive control and optimization





- General sequencing control
- Monitoring and warning
- Diagnostics and tests

Q.4

b) Attempt any one of the following:

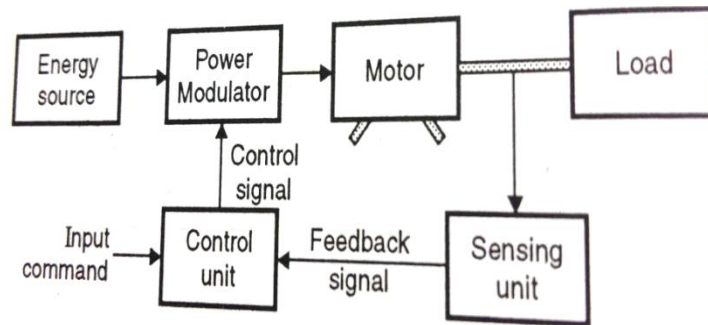
6M

i) Draw block diagram of basic elements of a drive. Explain each block in detail.

Ans:-

Diagram:

3M



Explanation:

3M

- Energy source: it can be an AC source or a DC source. It depends on the type of power modulator used.
- Power Modulator: It modulates the power flow from source to the motor. It limits the source current during starting and braking. Examples are rectifier, chopper inverter etc.
- Motor: It converts electrical energy to mechanical energy. Types are servo motor, synchronous motor, etc.
- Sensing unit: It senses the load parameter like speed or position and produces a signal proportional to the sensed parameter. The output goes to the control unit.
- Control unit: It compares input command signal and feedback signal and produces a command signal which drives the power modulator to reduce the error.

ii) Which type of drive/motor is used in steel- rolling mill at each stage? State specifications of drive at each stage

Ans:-



**Type of drivers motor used in steel rolling mill:-**

**3M**

- Steel rolling mills are hot rolled and cold rolled. They are also reversible or continuous type.
- Reverse hot rolling mills: Ward-Leonard method of speed control of DC motor is used. Induction motors and synchronous motors can be used.
- Continuous hot rolling mills: Ward-Leonard method of speed control of DC motor is used. Ac motors fed by thyristor converters is used.
- Reverse cold rolling mills: Ward-Leonard method of speed control of DC motor is used. Cyclo-converter fed synchronous motor may be used.
- Continuous cold rolling mills: Ward-Leonard method of speed control of DC motor is used.

**Specifications:**

**3M**

- High starting torque.
- Wide range of speed
- Large pull-out torque
- Fast acceleration, braking and reversal
- Accurate speed control
- Large overload capacity

**Q5 Attempt any FOUR of the following:**

**16M**

**a) Compare single phase and three phase drive.**

**Ans: (Any valid four points)**

**1M each**

<b>Single phase Drive</b>	<b>Three phase Drive</b>
1. The output ripple is large compared to three phase drive.	The output ripple is small.
2. They are used for low power application.	They are used for high power applications, up to megawatt power level.
3. The ripple frequency is small.	The ripple frequency is large
4. Filter requirement is high compared to three phase drives.	Filtering requirement is less
5. The armature current is not continuous. Motor heating is more due to harmonics	The armature current is mostly continuous. Motor heating is less.
6. Motor performance is better.	Motor performance is good.



b) A four pole three phase induction motor operates from a 240V supply at 50Hz. Calculate:

- (i) Speed of rotating magnetic flux.
- (ii) Speed of rotor if slip is 0.04.
- (iii) Speed of rotor if slip is 0.03.
- (iv) Frequency of rotor at standstill.

Ans:-

Given data,

Motor = 4 pole, 3 phase Induction motor

Supply voltage = 240 voltage

Frequency = 50Hz

i) Speed of rotating magnetic flux(NS)

01M

$$\begin{aligned}NS &= \frac{120 * f}{P} \\ &= \frac{120 * 50}{4} \\ NS &= 1500 \text{rpm}\end{aligned}$$

ii) Speed of rotor(N)

01M

$$\begin{aligned}N &= NS(1-S) \\ \text{Where } S &= 0.04 \\ N &= 1500(1-0.04) \\ N &= 1440 \text{rpm}\end{aligned}$$

iii) Speed of rotor(N)

01M

$$\begin{aligned}N &= NS(1-S) \\ \text{Where } S &= 0.03 \\ N &= 1500(1-0.03) \\ &= 1455 \text{rpm}\end{aligned}$$

iv) Frequency of rotor at standstill (fr)

01M

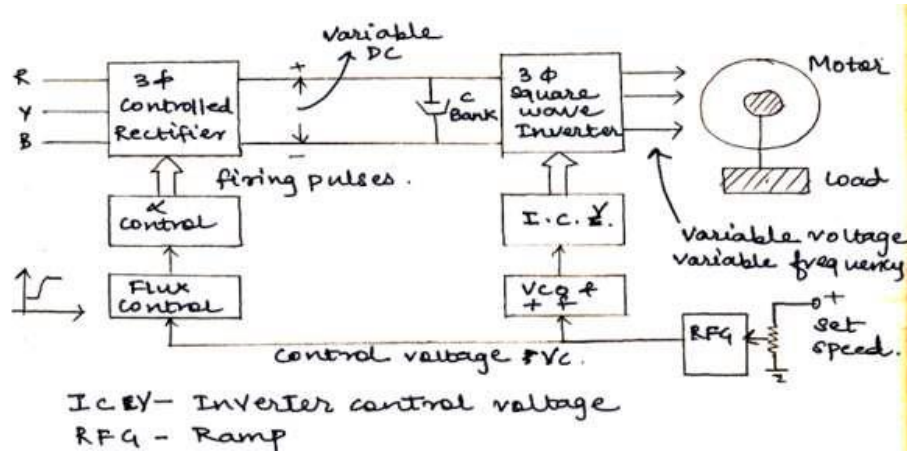
$$\begin{aligned}fr &= S * f \\ \text{Where } S &= 1 \\ fr &= 1 * 50 \\ fr &= 50 \text{ Hz}\end{aligned}$$

c) Describe the working of voltage/frequency control using square-wave inverter.

Ans:-

Diagram

02M



Explanation:

02M

- The output voltage of square wave inverter a variable DC voltage is required on the input side of the inverter. This is obtained from a 3 phase converter, filter combination on the input side of the inverter. The output frequency of the Inverter can be changed by changing the rate at which the devices connected in the inverter are switched ON & OFF. The VCO frequency will vary in proportional with DC controlled voltage to vary the inverter output frequency.
- The output waveform of the Inverter is a 6 step square waveform. A low percentage of harmonics will reduce the meter heating. Both the output frequency & voltage of the inverter should be variable in order to vary them simultaneously to keep the ratio constant . a common voltage control ( $V_c$ ) is used to vary both  $F_1$  and to vary both  $F_1$  and  $\alpha$ . The firing angle of three phase converter is changed in proportional with output voltage of the flux control circuit.
- The control voltage ( $V_c$ ) is obtained from a ramp function generator .
- The Ramp Frequency generator provides the start required at the starting of Induction motor.

Disadvantages of Square wave inverter:

**NOTE: DISADVANTAGES NOT COMPULSORY**

- The output voltage waveform contains lower order harmonics, which effects the motor heating specially.
- The input power factor of the converters is dependent on the firing angle  $\alpha$  which is very poor at high value of  $\alpha$  i.e. at low motor speed.



d) List different requirements of motor used for paper-mill application.

Ans:-

The paper mill machine should satisfy the following requirements. (Any four)

01 M each

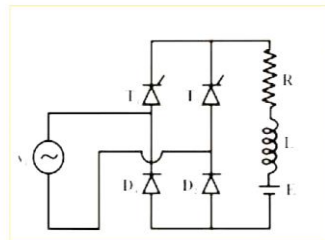
- The speed of the paper machine must be constant in video of economy while forming the sheets of paper.
- A speed control range of 10:1 is required so that it is suitable for performing several jobs.
- The arrangement should be capable of taking up sag.
- Even with correct speeds in the last 2 sections, uneven drying or the paper may cause variations in tension, which must be taken care of by suitable tension control.
- The motor must be capable of including in order that the wire be cleaned up.
- Every section must be able to run at crawling speeds.
- The starting and acceleration of the sections must be smooth as well as quick.

e) Draw the circuit diagram and waveforms for single phase semi-converter with symmetrical and asymmetrical configuration.

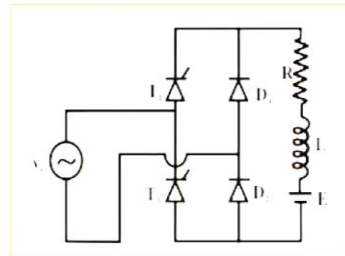
Ans:-

Diagram

02M



Symmetrical configuration of semiconverter



Asymmetrical configuration of semiconverter

Waveform

02M

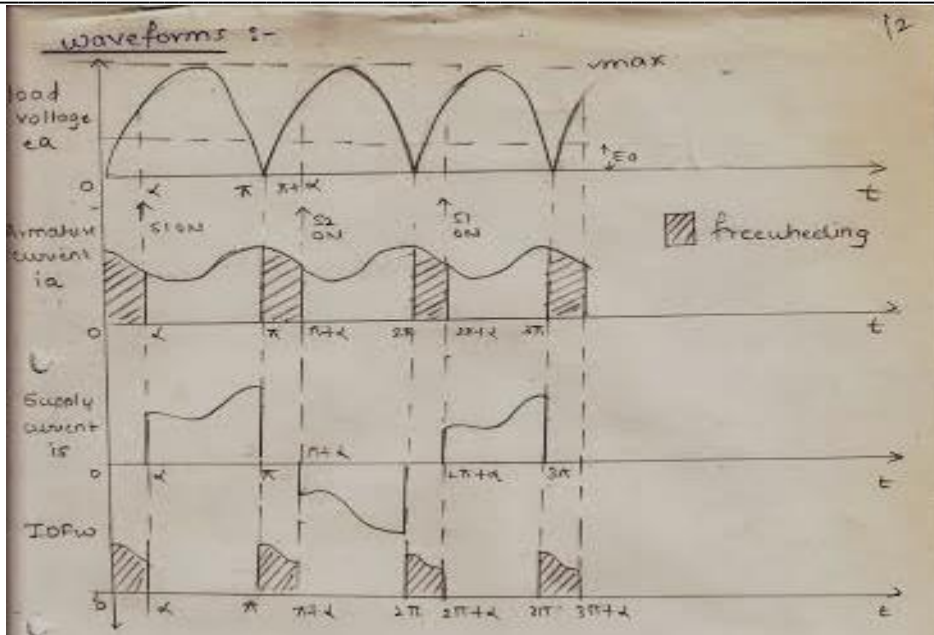


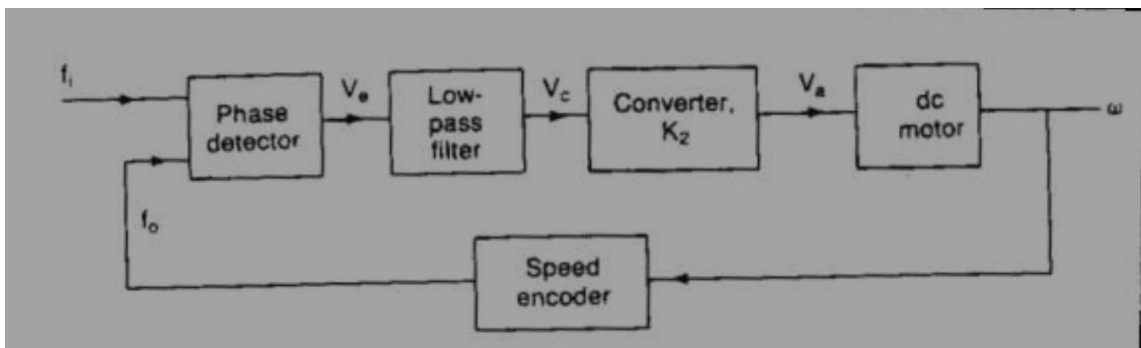
Fig. circuit diagram & waveforms

f) With the help of block schematic explain the use of phase locked loop (PLL) for speed control of DC motors. (Diagram:- 2Marks Explanation:- 2 Marks)

Ans:-

Diagram:

2M



Explanation

2M

The output of the encoder acts as the speed feedback signal of frequency  $f_0$

- The phase detector compare the reference pulse train  $f_i$  with the feedback frequency  $f_0$  and provides a



pulse width modulated output voltage  $V_e$  which is proportional to the difference in phases and references and feedback pulse trains.

- The phase detector is available in integrated circuits.
- A low pass loop filter converts the pulse train  $V_e$  to a continuous dc level  $V_c$  which varies the output of the power convertor and in turn the motor speed.
- The response of the phase detector is very fast.

**Q6. Attempt any four of the following:**

**16M**

**a) List four ratings and four specifications of stepper motor.**

**Ans:**

**Ratings of stepper motor are:- (ANY FOUR)**

**04M**

- Step angle –full step or half step-1.8 deg/0,9deg
- Micro stepping -bipolar unipolar
- Holding torque- 2000gm-cm
- NEMA frame size size 17
- Shaft diameter- 0.197 inches
- Power – 5 watts
- Voltage and current – 12V and 400mA
- Phase windings-4/2
- Ambient temperature-10 -55 deg centigrade
- Insulation resistance-greater than 100Mega Ohm at 500V D.C

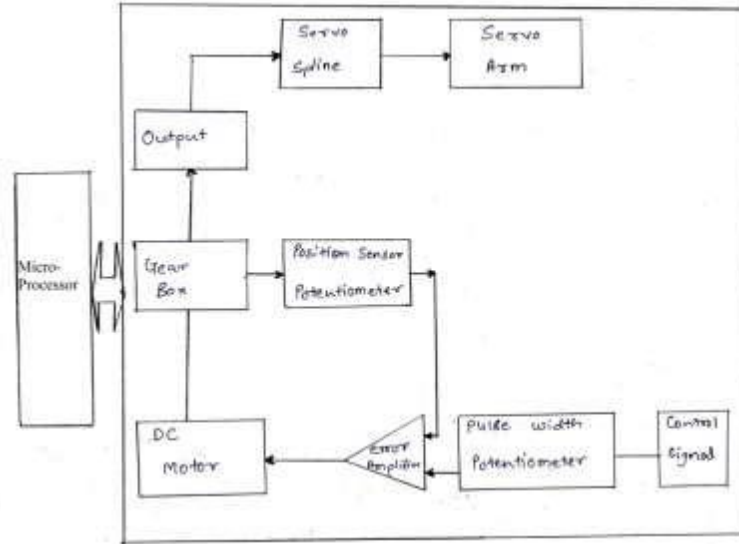
**b) Which type of drive motor is suitable for robotic arm? Explain its working with the diagram.**

**Ans:**

**NOTE: ANY OTHER RELEVANT BLOCK DIAGRAM USING STEPPER MOTOR CAN BE CONSIDERED**

**Diagram**

**02M**



**Explanation:-**

02M

DC servo motor is suitable for Robotic Arm.

1. Servo motor is nothing but a simple electrical motor with the help of servomechanism.
2. There are some applications of motor where rotation of the motor is required for just a certain angle not continuously for long period of time.
3. A servo motor is mainly consist of a DC motor, gear system, a position sensor (potentiometer) and control element.
4. Motor is connected to gear box assembly to provide feedback to position sender.
5. Output of motor is given to servomotor arm through servo spline.
6. Potentiometer changes position according to current position of motor.
7. So change in resistance provide change in voltage.
8. And then it is compared with voltage from feedback potentiometer.
9. Then error signal is amplified & given to motor and then much angle rotation of robotic arm/leg takes place.
10. Position or rotation of robotic arm /leg is depends on PWM control signal.

c) List the different speed control methods of induction motor. Explain any one in detail.

Ans:

Note: Any one method can be explained.



**The Speed of Induction Motor is changed from Both Stator and Rotor Side**

1M

The speed control of three phase induction motor from stator side are further classified as :

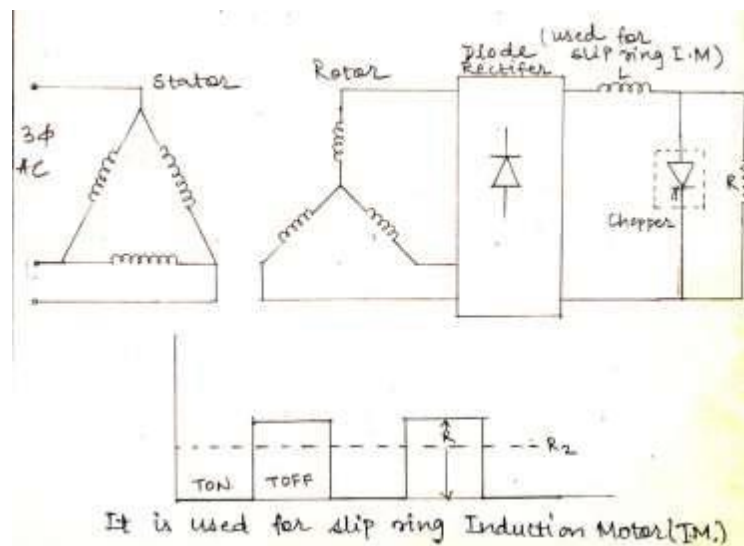
1. V / f control or frequency control.
2. Changing the number of stator poles.
3. Controlling supply voltage.
4. Adding rheostat in the stator circuit.

**The speed controls of three phase induction motor from rotor side are further classified as:**

1. Adding external resistance on rotor side.
2. Rotor voltage control

**Rotor resistance control using chopper****Diagram:-**

2M

**Fig: chopper controlled induction motor****Explanation:**

01M

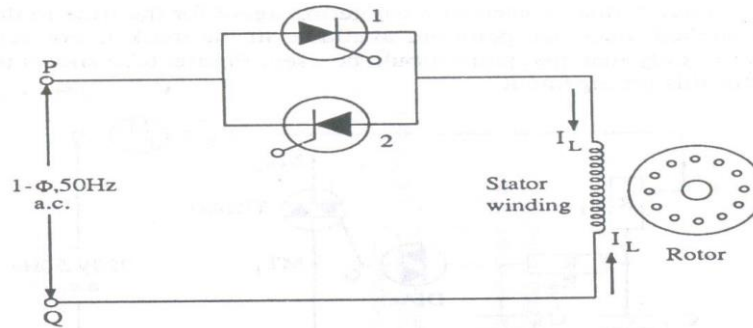
- i) Speed control by means of slip variation can be achieved by using a variable resistance in the rotor circuit. The maximum value of torque does not depend upon the value of rotor resistance.
- ii) Rotor resistance influences the slip at which maximum torque occurs. External resistances can be added very conveniently to the phases of the slip ring induction motor.
- iii) With the development of thyristors which has lead to the chopper control resistance in the rotor circuit.
- iv) The resistance across output terminal of a chopper can be varied from 0 to R by changing the time ratio (Duty cycle) of the chopper. The slip power of the rotor is rectified through a diode bridge rectifier and fed to the chopper control resistance.
- v) The smoothing inductor is used in the circuit to maintain the current at constant value.

vi) The rating of the chopper decides the maximum rotor current of the motor.

vii) It is suitable for load such as elevators, lifts but the speed control range is limited by the resistance.

OR

**Stator Voltage Control Method**

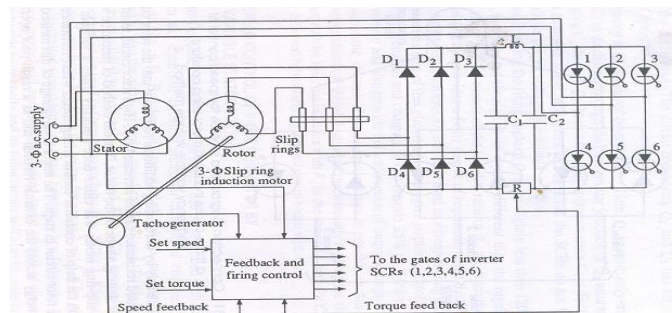


**Explanation :**

- Two SCRs are connected anti parallel.
- During the positive half cycle SCR1 is triggered.
- The direction of the current in the stator winding is from the top to bottom.
- In the negative half cycle SCR1 is turned off and SCR2 is triggered.
- The direction of the flow of current in the stator winding is reversed biased.
- By varying the firing angles of SCR1 and 2, the magnitude of a.c. voltage across the stator winding of the motor can be controlled.
- This in turn will vary the motor speed.

OR

**Slip energy recovery system method:-**



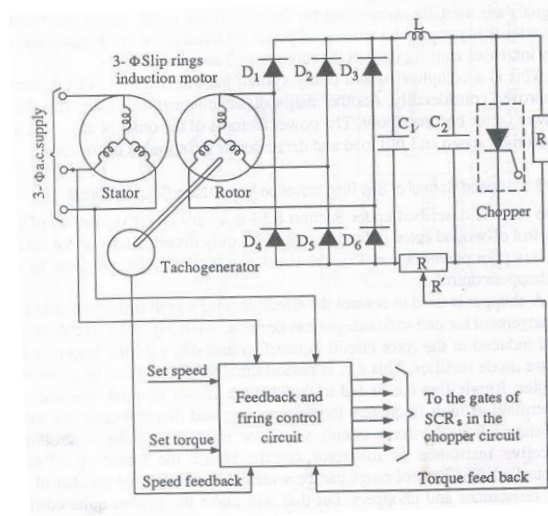
Diode D1, D2, D3, D4, D5 and D6 acts as a rectifier.

- L, C1 and C2 form a pie network filter.
- SCRs 1, 2,3,4,5 and 6 act as an inverter.

- The firing angle of the inverter can vary the amount of power extracted from rotor circuit and thus the rotor speed is varied.
- The power output of inverter circuit is fed back to the a.c. supply mains and thus forms a regenerative control.
- The system is made closed loop by comparing actual speed and torque and the desired speed and torque of motor with the help of tacho-generator

OR

**Chopper control of induction motor drive employing motor resistance control technique**



Diode D1,D2,D3,D4,D5 and D6 acts as a rectifier.

- L,C1 and C2 form a pie network filter.
- The chopper is controlled at high frequency and thus connecting and disconnecting the external Resistance are in the rotor circuit at regular intervals.
- Hence the Motor speed can be controlled.

The system is made closed loop by comparing actual speed and torque and the desired speed and torque of motor with the help of tacho generator.

d) Write different stages and drives required for sugar mills.

Ans:

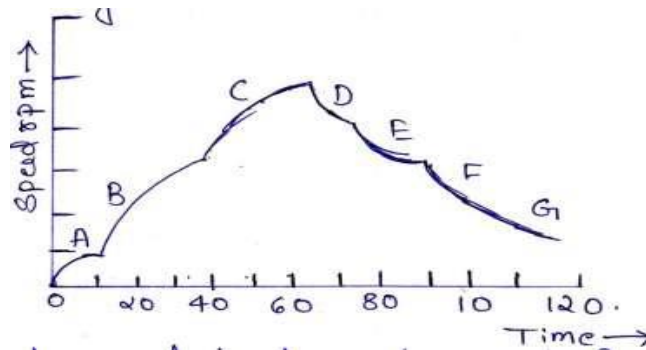
Different stages

02M

**1. Separation:** In sugar mill the sugar crystals are separated from the syrup by mean of a centrifuge. The separation is accomplished by the centrifugal set up.

**2. Charging:-**The centrifuge is started to a speed of around 200rpm at which the charging of syrup takes place. during charging the motor is disconnected from the supply.

**3. Plugging:-**the centrifuge is spun at speed of 500 & 1000 rpm. -the speed is then reduced in steps to about 50 rpm, at which plugging takes place. -A typical load cycle of a centrifuge is Shown below



Drives used for sugar mills

02M

1. The motor used to drive the centrifuge is a variable speed motor like slip ring induction motor. Regenerative braking is employed. Stator voltage control can be used.
2. A synchronous motor or converter fed induction motor can also be used for speed control purposes.

e) Draw block diagram of closed loop control of synchronous motor.

Ans:

Diagram :-

04M

