Balasore School of Engineering

Power Electronics & Drives

Branch – Electrical Engineering

Semester – 5th

Sub Code – EET 502

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CHAPTER-01

SHORT QUESTIONS

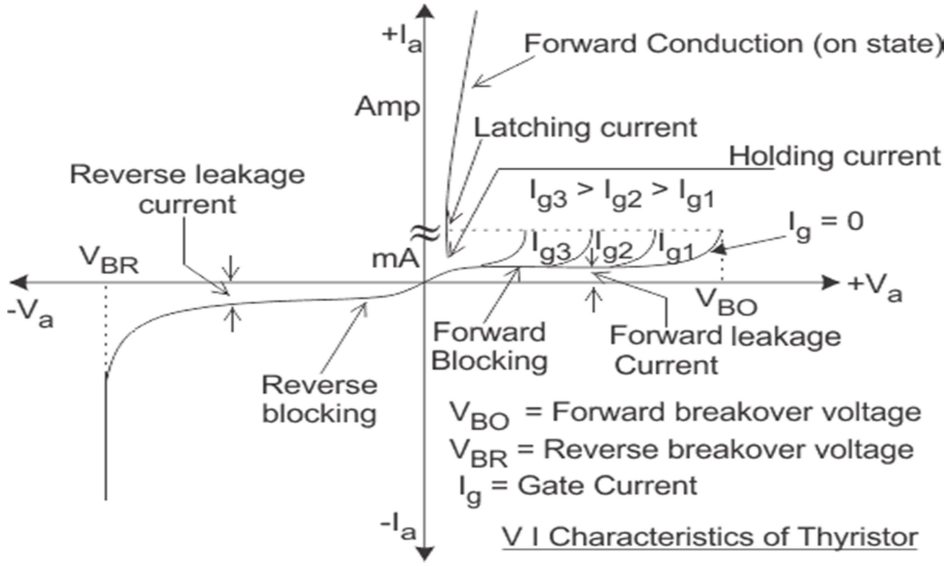
(1)What is rise time?(2015(W))

Ans:It is the time during which90% to 10% of its initial value and current increases 10% to 90% of its final value.

(2) What is the meaning of switching characteristics of scr?

Ans: It is the dynamic charachteristics of scr which shows the variation in voltage and current w.r.t. time during turn on and turn off.

(3)Show the holding current of scr in static characteristics? (2013(s)bp)



(4) What is Delay time?(2018)

Ans. Delay time of SCR can be defined as the time taken by the gate current to increase from 90% to 100% of its final value I_g. From another point of view, **delay time** is the interval in which anode current rises from forward leakage current to 10% of its final value and at the same time anode voltage will fall from 100% to 90% of its initial value V_a.

(5)What is the difference between natural commutation and forced commutation?(2018)

Ans: **Natural Commutation-**

It occurs in AC circuits i.e. when supply voltage is AC. Due to this, SCR turns off when negative voltage appears across the SCR. As

there are no special circuits needed to turn off the SCR (thyristor), this type of commutation is known as naturalcommutation**.**

➨**Natural Commutation in Thyristors take place in Phase controlled rectifiers, AC voltage controllers and Cyclo converters.**

Forced Commutation

➨It is Applied to dc circuits.

➨Forced Commutation is achieved by reverse biasing SCR device or by reducing SCR current below the holding current value.

➨Commutating elements such as inductance and capacitance are used here.

➨**Forced commutation** is applied to choppers and inverters.

(6)What is surge current rating of thyristor?(2018)

Ans: It specifies the maximum non-repetitive or surge current that the SCR can withstand for a limited number of times during its life span. The manufacturers specify the surge rating to accommodate the abnormal conditions of SCR due to short circuits and faults. If the peak amplitude and the number of cycles of the surge current are exceeded, the SCR may get damaged.

MEDIUM QUESTIONS

Q(1) Describe Overcurrent and gate protection of thyristor? (2015(w),2018)

Ans: Over Current Protection

Overcurrent mainly occurs due to different types of faults in the circuit. Due to overcurrent i^2R loss will increase and high generation of heat may take place that can exceed the permissible limit and burn the device.

Protective Measure: SCR can be protected from overcurrent by using Circuit Breaker (CB) and fast acting current limiting fuses (FACLF). CBs are used for protection of thyristor against continuous overloads or against surge currents of long duration as a CB has long tripping time. But fast-acting fuses is used for protecting SCR against high surge current of very short duration.

GATE PROTECTION

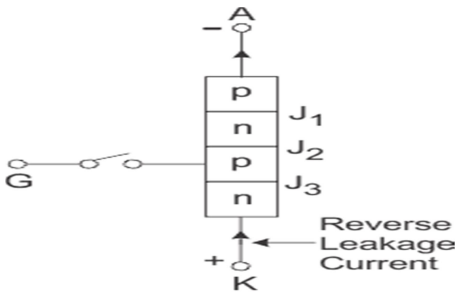
(1) Protection against overvoltage is achieved by connecting a zener diode across the gate circuit. A resistor R_2 connected in series with the gate circuit provides protection against gate current.

(2) Gate protection against spurious firing is obtained by using shielded cables or twisted gate leads.

(3) A capacitor and a resistor is also connected across the gate to cathode to bypass noise signals.
Figure

Q(2) Explain the working of scr with necessary diagram?(2013(s)bp)(2015(w))

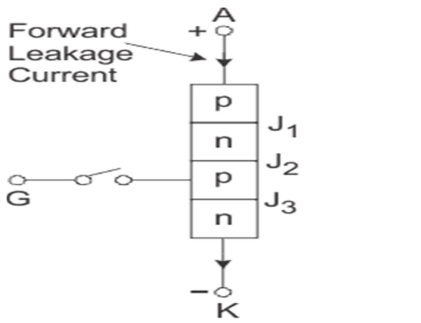
Ans: Reverse Blocking Mode of Thyristor



Reverse Blocking Mode

In this mode cathode is made +ve w.r.t. anode with gate open. Thyristor is reverse biased. A small leakage current of mA or μA flows in the SCR. This is called OFF state of SCR. Beyond a certain voltage $V_{BR,}$ called breakdown voltage, current suddenly increases which can burn the SCR due to excessive heat produced in the SCR.

Forward Blocking Mode

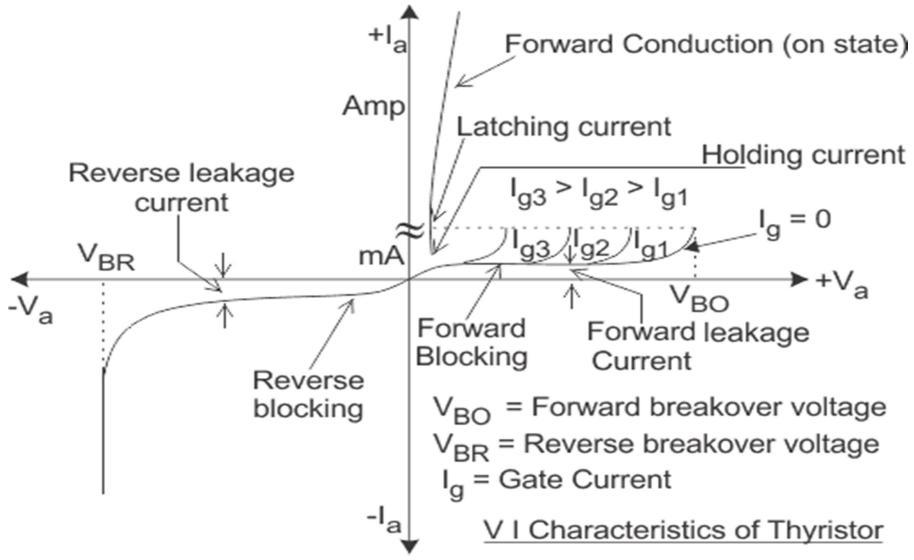


Forward Biased Condition

When anode is made +ve w.r.t. cathode with gate circuit open, it is called forward biased. In this case, as J_1 and J_2 are forward biased but J_2 is reversed biased, a small leakage current called forward leakage current flows in it. As long as applied voltage is less than forward break over voltage, $V_{BO,}$, SCR is in OFF state. This is called forward blocking mode.

Forward Conduction Mode

If the applied voltage exceeds V_{BO} then scr starts conducting in forward direction. This is called forward conduction mode. In this mode, SCR is in ON state. Its voltage drop is 1 or 2 volt.



(3)Explain any three turn on methods of thyristor.(2018)

Ans: Forward Voltage Triggering

One of the commonly used SCR Turn On methods is by increasing the forward anode to cathode voltage. By doing this, the depletion layer width is also increasing at junction J2. This also causes to increase the minority charge carriers accelerating voltage at junction J2. This further leads to an avalanche breakdown of the junction J2 at a forward breakover voltage VBO.

At this stage SCR turns into conduction mode and hence a large current flow through it with a low voltage drop across it. During the turn ON state the forward voltage drop across the SCR is in the range of 1 to 1.5 volts and this may be increased with the load current.

In practice this method is not employed because it needs a very large anode to cathode voltage. And also once the voltage is more than the VBO, it generates very high currents which may cause damage to the SCR. Therefore, most of the cases this type of triggering is

avoided.

Temperature Triggering

The reverse leakage current depends on the temperature. If the temperature is increased to a certain value, the number of hole-pairs also increases. This causes to increase the leakage current and further it increases the current gains of the SCR. This starts the

regenerative action inside the SCR since the (α1 + α2) value approaches to unity (as the current gains increases).

By increasing the temperature at junction J2 causes the breakdown of the junction and hence it conducts. This triggering occur in some circumstances particularly when it the device temperature is more (also called false triggering). This type of triggering is practically not employed because it causes the thermal runaway and hence the device or SCR may be damaged.

dv/dt Triggering

In forward blocking state junctions J1 and J3 are forward biased and J2 is reverse biased. So the junction J2 behaves as a capacitor (of two conducting plates J1 and J3 with a dielectric J2) due to the space charges in the depletion region. The charging current of the capacitor is given as

I = C dv/ dt

where dv/dt is the rate of change of applied voltage and C is the junction capacitance.

From the above equation, if the rate of change of the applied voltage is large that leads to increase the charging current which is enough to increase the value of alpha. So the SCR becomes turned ON without a gate signal.

However, this method is also practically avoided because it is a false turn ON process and also this can produce very high voltage spikes across the SCR so there will be considerable damage to it.

LONG QUESTIONS

Q(1) Draw the switching characteristics of scr and explain the waveform during turn on and turn off?2013(s(BP),2018w)

Ans: Turn ON Time of SCR

A forward biased thyristor can be turned on by applying a positive voltage between gate and cathode terminal. But it takes some transition time to go from forward blocking mode to forward conduction mode. This transition time is called turn on time of SCR and it can be subdivided into three small intervals as delay time (t_d) rise time (t_r), spread time (t_s).

Delay Time of SCR

After application of gate current, the thyristor will start conducting over a very tiny region. Delay time of SCR can be defined as the time taken by the gate current to increase from 90% to 100% of its final value I_g. From another point of view, delay time is the interval in which anode current rises from

forward leakage current to 10% of its final value and at the same time anode voltage will fall from 100% to 90% of its initial value V_a.

Rise Time of SCR

Rise time of SCR in the time taken by the anode current to rise from 10% to 90% of its final value. At the same time anode voltage will fall from 90% to 10% of its initial value V_a

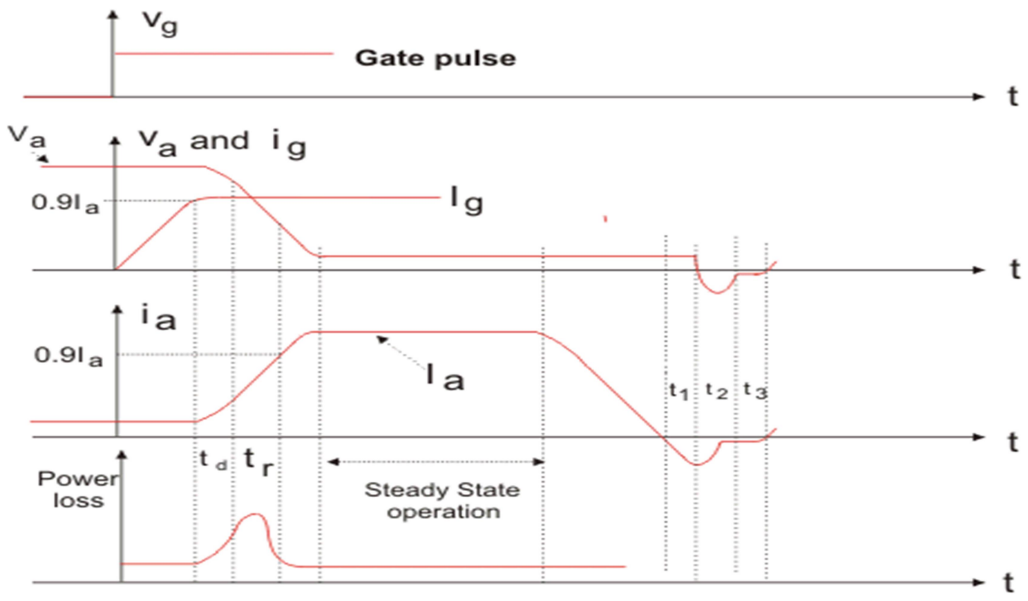
Spread Time of SCR

It is the time taken by the anode current to rise from 90% to 100% of its final value. At the same time the anode voltage decreases from 10% of its initial value to smallest possible value. In this interval of time conduction spreads all over the area of cathode and the SCR will go to fully ON State. Spread time of SCR depends upon the cross-sectional area of cathode.

Turn OFF Time of SCR

That means gate circuit cannot turn off the device. For turning off the SCR anode current must fall below the holding current. After anode current fall to zero we cannot apply forward voltage across the device due to presence of carrier charges into the four layers. So we must sweep out or recombine these charges to proper turn off of SCR**.** So turn off time of SCR can be defined as the interval between anode current falls to zero and device regains its forward blocking mode. On the basis of removing carrier charges from the four layers, turn off time of SCR can be divided into two time regions,

1. Reverse Recovery Time.
2. Gate Recovery Time



Reverse Recovery Time

It is the interval in which change carriers remove from J_1, and J_3 junction. At time t_1, anode current falls to zero and it will continue to increase in reverse direction At the time t_2 carrier charge density is not sufficient to maintain the reverse current hence after t_2 this negative current will start to decrease. The value of current at t_2 is called reverse recovery current. Total recovery time t_3 - t_1 is called reverse recovery time.

Gate Recovery Time

After sweeping out the carrier charges from junction J_1 and J_3 during reverse recovery time**,** there still remain trapped charges in J_2 junction which prevent the SCR from blocking the forward voltage. These trapped charges can be removed by recombination only and the interval in which this recombination is done, called gate recovery time**.**

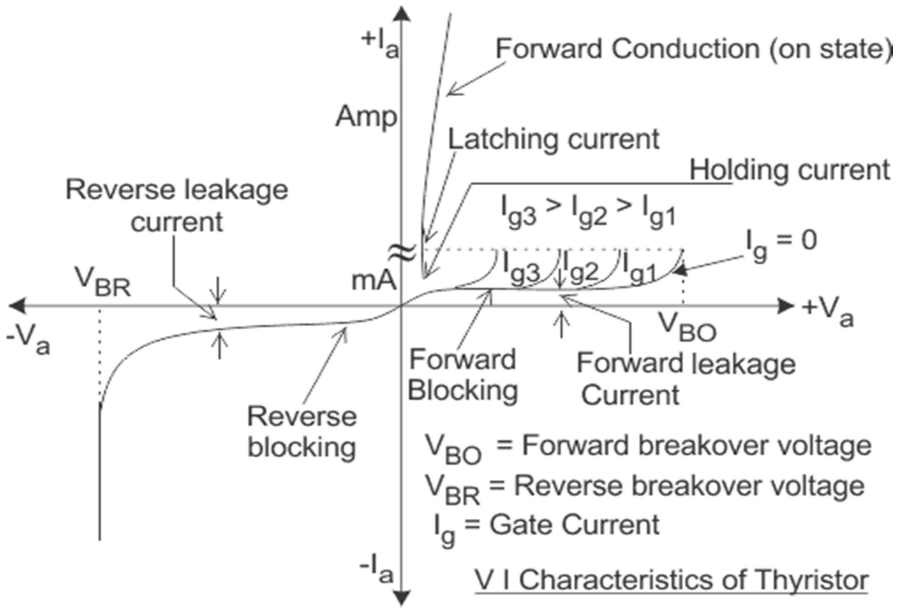
CHAPTER-02

SHORT QUESTIONS

Q(1) What is the difference between R firing and RC firing?()2014(w)

Ans: In rc firing the firing angle is in between 0^o and 180^o but in r firing it is between 0^o and 90^o.

Q(2) Show the holding current of scr in static V-I characteristics.(2013)(bp)



Q(3) What is the meaning of switching characteristics of thyristor?(2013)(bp)

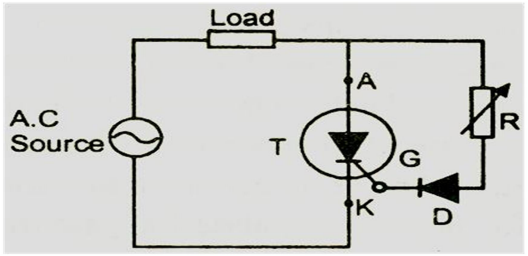
Ans: It is the curve between voltage/current w.r.t. time. It is also called dynamic characteristics.

MEDIUM QUESTIONS

Q(1)Explain gate triggering of thyristor by resistance firing?(2015(W))

Ans : R firing circuits or Resistance triggering circuit:

The following circuit shows the resistance triggering. In this method, the variable resistance R is used to control the gate current.

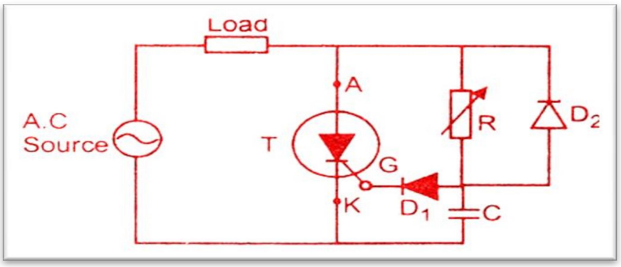


Depending upon the value of R, when the magnitude of the gate current reaches the sufficient value(latching current of the device) the SCR starts to conduct. The diode D is called as blocking diode. It prevents the gate cathode junction from getting damaged in the negative half cycle. By considering that the gate circuit is purely resistive, the gate current is in phase with the applied voltage. By using this method we can achieve maximum firing angle up to 90°.

Q(2) With neat diagram explain the working of R-C firing circuit.(2013(bp),2018w)

Ans: **RC-firing circuit**

The following circuit shows the resistance-capacitance triggering.



By using this method we can achieve firing angle more than 90°. In the positive half cycle, the capacitor is charged through the variable resistance R up to the peak value of the applied voltage. The variable resistor R controls the charging time of the capacitor. Depends upon the voltage across the capacitor, when sufficient amount of gate current will flow in the circuit, the SCR starts to conduct. In the negative half cycle, the capacitor C is charged up to the negative peak value through the diode D2. Diode D1 is used to prevent the reverse break down of the gate cathode junction in the negative half cycle.

CHAPTER-03

SHORT QUESTIONS

Q(1) What is latching current?

Ans: It is the minimum anode current above which an scr must attain to continue conduction without gate triggering.

Q(2) What is the difference between uncontrolled rectifier and controlled rectifier?

Ans : Uncontrolled rectifier are semiconductor diodes in which phase can't be controlled. Controlled rectifiers are scrs which can control phase.

Medium questions

Q (1) Explain 1-Φ half bridge converter?(2015(w))

Ans :

The single phase half controlled bridge converter consists of SCR and diodes.

(i) During +ve half cycle of the supply voltage i.e. V_{AB} thyristor T_1, diode D_1 are in forward biased condition.

When a gate pulse is given to SCR T_1, it starts conducting and current i_o flows through load. Vb The current continues to flow until SCR T_1 gets commutated by the reversal of supply voltage at $\omega t=\prod$.

(ii) During –ve half cycle of supply voltage, i.e., V_{ba}, the SCR T_2 and diode D_2 are in forward biased condition. When a gate pulse is given to SCR T_2 at $\omega t=\prod+\alpha$ starts conducting and the current will flow through the load. $V_o=(1/\prod)\int_{\alpha}^{\prod} V_m \sin\omega t\, d(\omega t)=(V_m/\prod)[-\cos\omega t]_{\alpha}^{\prod}=(V_m/\prod)(1+\cos\alpha)$.

(iii) Hence load current, $i_o=V_{o/R}=(V_m/(\prod R))(1+\cos\alpha)$.

LONG QUESTIONS

Q(2)Explain the working of half-wave converter with R-L load with and without freewheeling diode. Show the output waveforms under the above use?(2014(w),2018)

Ans: SCR as a Half Wave Rectifier with R load and without freewheeling diode

(i) A supply of $V_s=V_m\sin\omega t$ is given to R-L type load. During +ve half cycle of the supply vltage SCR is forward biased. When gate signal is given to SCR, it starts conducting and load voltage follows supply voltage.

(ii) The energy gets stored in the inductor during the interval $\omega t=\alpha$ to $\omega t=\prod$.At $\omega t=\prod$, source voltage and load voltage becomes zero. The load current doesn't become zero due to presence of inductance in the load circuit. So the SCR doesn't get commutated at some point denoted by β after $\omega t=\prod$.β is known as extinction angle.
Conduction angle(γ)=It is the angle at which SCR is in conduction state. The relation between α,β,γ is given by-$\beta=\alpha+\gamma$.

(iii) During –ve half cycle at $\omega t=\beta$, current flowing through the SCR becomes zero. Hence it is naturally commutated. The output voltage and current becomes zero. The SCR is reverse biased from $\omega t=\beta$ to $2\prod$.Hence circuit turn off time, $t_c=(2\prod-\beta)/\omega$.

SCR as a Half Wave Rectifier with R load and with freewheeling diode

The diode used in single phase half wave rectifier is known as flywheeling ,bypass or commutating diode.

Advantages of freewheeling diode

(i) The load current waveform is improved.
(ii) The load performance is better.
(iii) The input power factor is improved.

Figure

CHAPTER-04

SHORT QUESTIONS

Q(1) Classify inverters.(2018)

Ans:According to commutation methods

- Line commutated inverter
- Forced commutated inverter

According to supply sources

- Voltage source inverter
- Current source inverter

According to connection of semiconductor devices

- Bridge inverter : Half bridge inverter and Full bridge inverter
- Series inverter
- Parallel inverter

LONG QUESTIONS

Q(1) Explain the working of voltage source series inverter with neat diagram.(2014(w))(2013*(bp),2018)

Ans:

Series Inverter

Voltage source series inverter consists of load resistance R in series with commutaing components L and C. The RLC circuit is an underdamped circuit.

Mode-1

A dc supply is connected to the inverter circuit. When the scr T_1 is turned onby giving gate signal to it,T_1 starts conducting. It results in current flow through R-L-C series circuit. Now the capacitor C gets charged up to a voltage E_c with the polarity as shown in the figure. The load current flows through the path V_s^+-T_1-C-L-R-V_s^-.

When the load current reaches its peak value, the voltage across the capacitor "C" is the supply voltage V_s. After this current starts deceasing whereas the capacitor voltage rises to value (V_S=E_C+V_S).When the load current reaches zero, SCR T_1 is turned off.

Mode-2

During this mode, the load current remains constant for sufficient period of time before scr T_2 is triggered. Both scr T_1 and T_2 are in off state. The capacitor voltage remains constant.

Mode-3

The +ve polarity of capacitor "c" appears at the anode of scrT_2 and hence T_2 is forward biased. When scr T_2 is triggered it starts conducting and the capacitor discharges through

Scr T_2 .The load current direction is opposite to that of assigned load current direction. The load current flows through path C^+-T_2-R-L-C^-.This current builds off to –ve maximum and reaches to zero value. Scr T_2 is turned off. This process is repeated.

CHAPTER-05

SHORT QUESTIONS

Q(1) What happens to frequency in PWM operation of chopper?(2013)(bp)

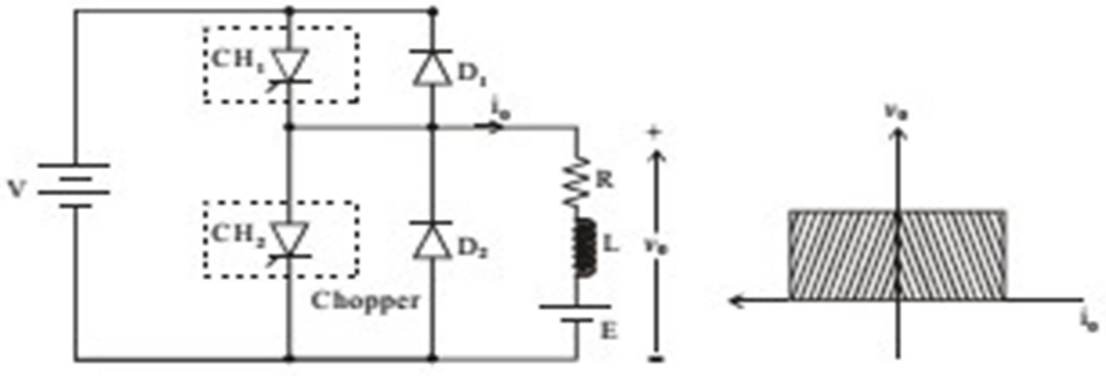
Ans: In this scheme, on-time T_{on} is varied but chopping frequency is constant.

MEDIUM QUESTIONS

Q(1) Explain type-c chopper.

Ans: Two Quadrant Class-C Chopper

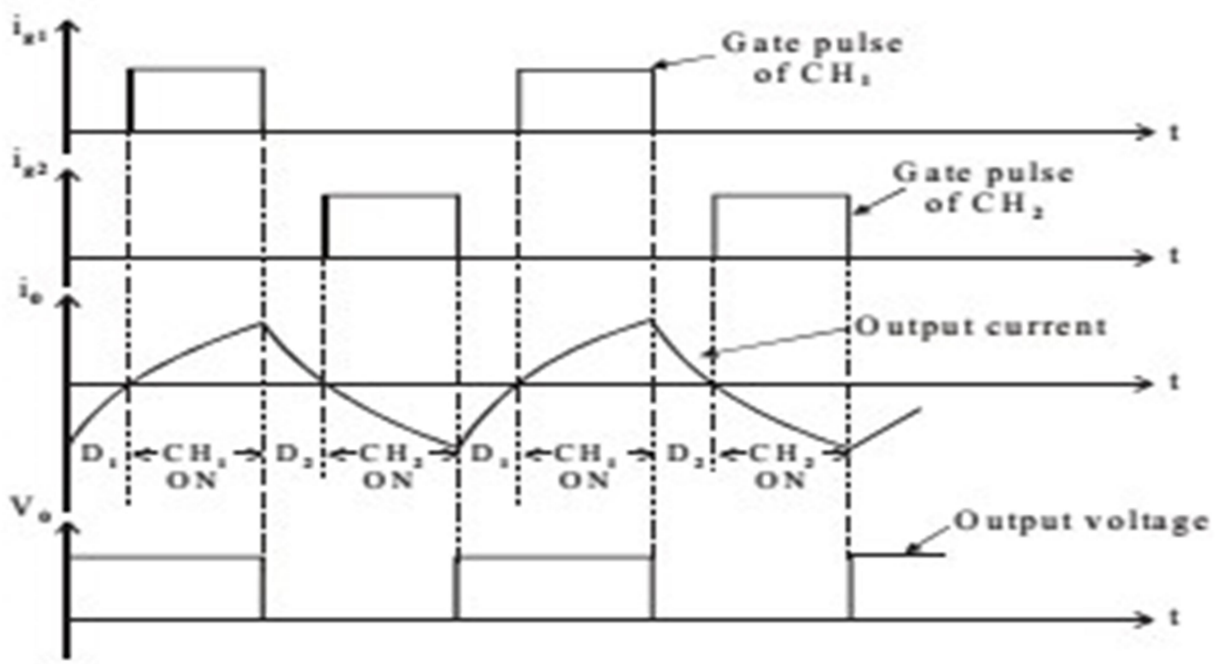
Class C Chopper is a combination of Class A and Class B Choppers. For first quadrant operation, CH_1 is ON or D_2 conducts.



For second quadrant operation, CH_2 is ON or D_1 conducts. When CH_1 is ON, the load current is positive. The output voltage is equal to ‗V' & the load receives power from the source. When CH_1 is turned OFF, energy stored in inductance L forces current to flow through the diode D_2 and the output voltage is zero. Current continues to flow in positive direction.

When CH_2 is triggered, the voltage E forces current to flow in opposite direction through L and CH_2. The output voltage is zero. On turning OFF CH_2, the energy stored in the inductance drives current through diode D_1 and the supply. Output voltage is V, the input current becomes negative and power flows from load to source. Average output voltage is positive. Average output current can take both positive and negative values. Choppers CH_1 & CH_2 should not be turned ON simultaneously as it would result in short circuiting the supply.

Class C Chopper can be used both for dc motor control and regenerative braking of dc motor. Class C Chopper can be used as a step-up or step-down chopper.



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CHAPTER-06

LONG QUESTIONS

Q(1) What is a cycloconverter ?(2018)Explain the circuit and waveform of step-up cycloconverter.(2013(bp))

Ans: Circuit Description

(i)Here the scrs are arranged in bridge type and is known as bridge type cycloconverter.

(ii)It has eight scrs(P_1,P_2,P_3,P_4) constitute +ve group whereas (N_1,N_2,N_3,N_4) constitute –ve group.

(iii)Load is connected between two bridges which are connected anti-parallel.

FIGURE

Operation

Mode-1 $(0 < \omega t < \prod)$

(i)During the +ve half cycle of supply voltage, P1, P2, N3, N4 are forward biased. Initially P_1&P_2 are triggered. The load voltage follows the +ve envelope of supply voltage. The circuit completes its path through a-P_1-X-load-Y-P_2-b.

(ii)At instant ϕt$_1$,P $_1$& P$_2$ are turned off due to forced commutation.N$_3$ & N$_4$ are turned on. The output voltage follows the –ve envelope of supply voltage. The circuit completes its path through N-N$_3$-Y-load-X-N4-M.At ϕt$_2$ N$_3$, N$_4$ are forced commutated and P$_1$, P$_2$ are turned on. This process continues till ϕt=∏ radian.

Mode-2 (∏ < ϕt < 2∏)

(i)During –ve half cycle of supply voltage, thyristors P$_3$,P$_4$,N$_1$,N$_2$ are forward biased.P$_3$,P$_4$ are turned on by giving the gate signal where the load voltage

follows the +ve envelope of the supply voltage .The circuit competes its path through b-P$_3$-X-load-Y-P$_4$-a.

(ii)At instant ϕt$_4$, P$_3$, P$_4$are forced commutated. The gate signal is given to N$_1$,N$_2$.The output voltage traces the –ve envelope of supply voltage. The current flow is:-M-N$_1$-Y-load-X-N$_2$-N.In this way, +ve and -ve envelopes are traced during ∏ to 2∏.

CHAPTER-07

SHORT QUESTIONS

Q(1) What is the difference between power diode and signal diode?(2015(w))

Ans: (i) The voltage, current and power rating of power diodes are more than signal diodes.

(ii) The switching speed of power diodes is less than signal diodes.

Q(2) **What do you mean by power BJT?(**2014(w))

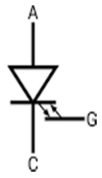
(i) The power BJT has four layers N$^+$-P-N—N$^+$.

(ii) The characteristics of the device is determined by the doping level in each of the layers and the thickness of the layers.

(iii)The thickness of the dirft region determines the breakdown voltage of the Power transistor.

Q(3) Draw the symbol of GTO and give its applications.(2014(w))

Ans: Symbol



Application: motor drives, static VAR compensators (SVCs) and AC/DC power supplies with high power ratings.

Q(4) Draw the forward and reverse characteristics of an ideal diode.(2013(bp))

Ans:

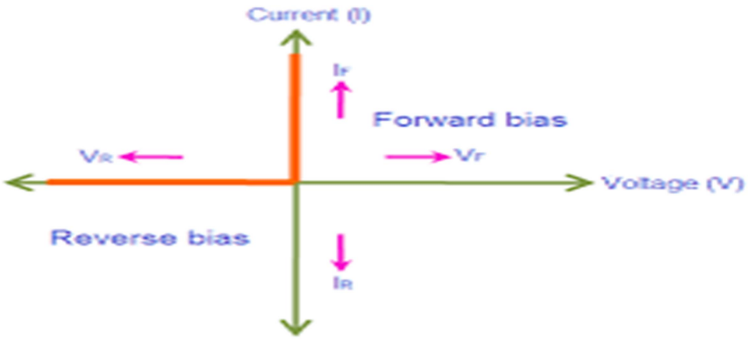
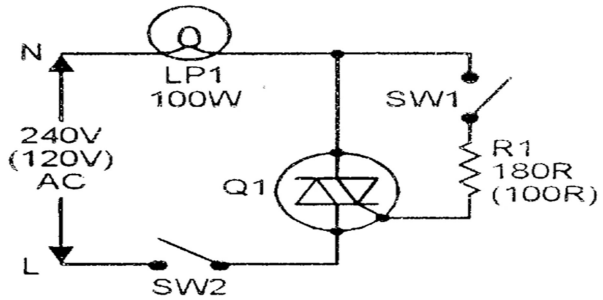


Fig: V-I characteristics of ideal diode

Q(5) Show connection diagram of triac feeding power to resistive load.(2013)(bp)

Ans:



MEDIUM QUESTIONS

Q(2) Explain the working of power diode and show the difference between power diode and signal diode?(2013)(bp)(2014(w))

Ans :

A power diode has a P-I-N structure as compared to the signal diode having a P-N structure. Here, I (in P-I-N) stands for intrinsic semiconductor layer to bear the high-level reverse voltage as compared to the signal diode (n- , drift region layer shown in Fig. 2). However, the drawback of this intrinsic layer is that it adds noticeable resistance during forward-biased condition. Thus, power diode requires a proper cooling arrangement for handling large power dissipation. Power diodes are used in numerous applications including rectifier, voltage clamper, voltage multiplier and etc. Power diode symbol is the same as of the signal diode as shown in Fig.1.

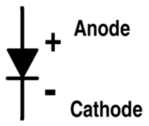


Figure 1. Symbol for Power Diode

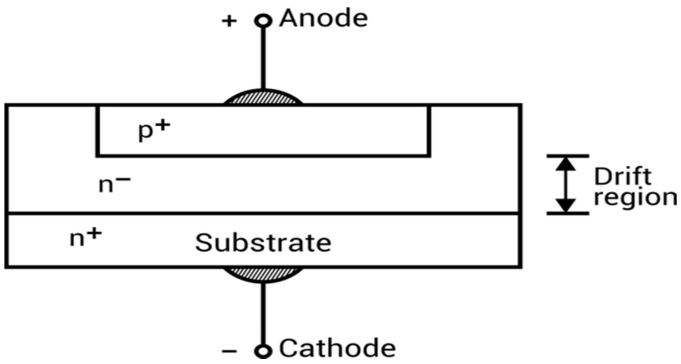


Figure 2. Structure of Power Diode

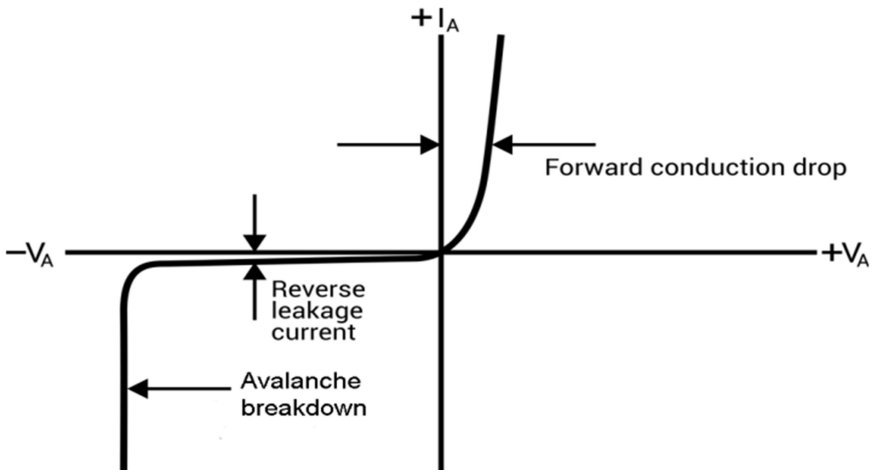
If thickness of lightly doped I layer (n- layer) > depletion layer width at breakdown ⇒ Non-punch through power diode.

(This means depletion layer has not punched through the lightly-doped n-layer.)

If thickness of I layer < depletion layer width at breakdown ⇒ Punch through power diode.

Characteristics of Power Diode

Amp-volt characteristics *(i-v characteristics)*



Cut-in voltage is the value of the minimum voltage for V_A (anode voltage) to make the diode works in forward conducting mode. Cut-in voltage of signal diode is 0.7 V while in power diode it is 1 V. So, its typical forward conduction drop is larger. Under forward-bias condition, signal diode current increases exponentially and then increases linearly. In the case of the power diode, it almost increases linearly with the applied voltage as all the layers of P-I-N remain saturated with minority carriers under forward bias. Thus, a high value of current produces results in voltage drop which mask the exponential part of the curve. In reverse-bias condition, small leakage current flows due to minority carriers until the avalanche breakdown appears as shown in Fig. 3.

CHAPTER-08

SHORT QUESTIONS

Q(1)What is the use of UPS.?(2015(w))

Ans: Applications are major computer installations, process control in chemical plants, safety monitors, hospital intensive care units.

Q(2) What is SMPS and why it is preferred in comparison to linear regulator?(2014(w))

Ans : SMPS stands for Switched Mode Power Supply. In case of SMPS negligible ripples are produced, efficient, light than linear regulator.

MEDIUM QUESTIONS

Q(1)Explain single phase full wave ac regulator.((2015((w))

Ans :-(i) The above figure shows the 1-Φ ac voltage controller with resistive load. It consists of two thyristors connected in anti-parallel.

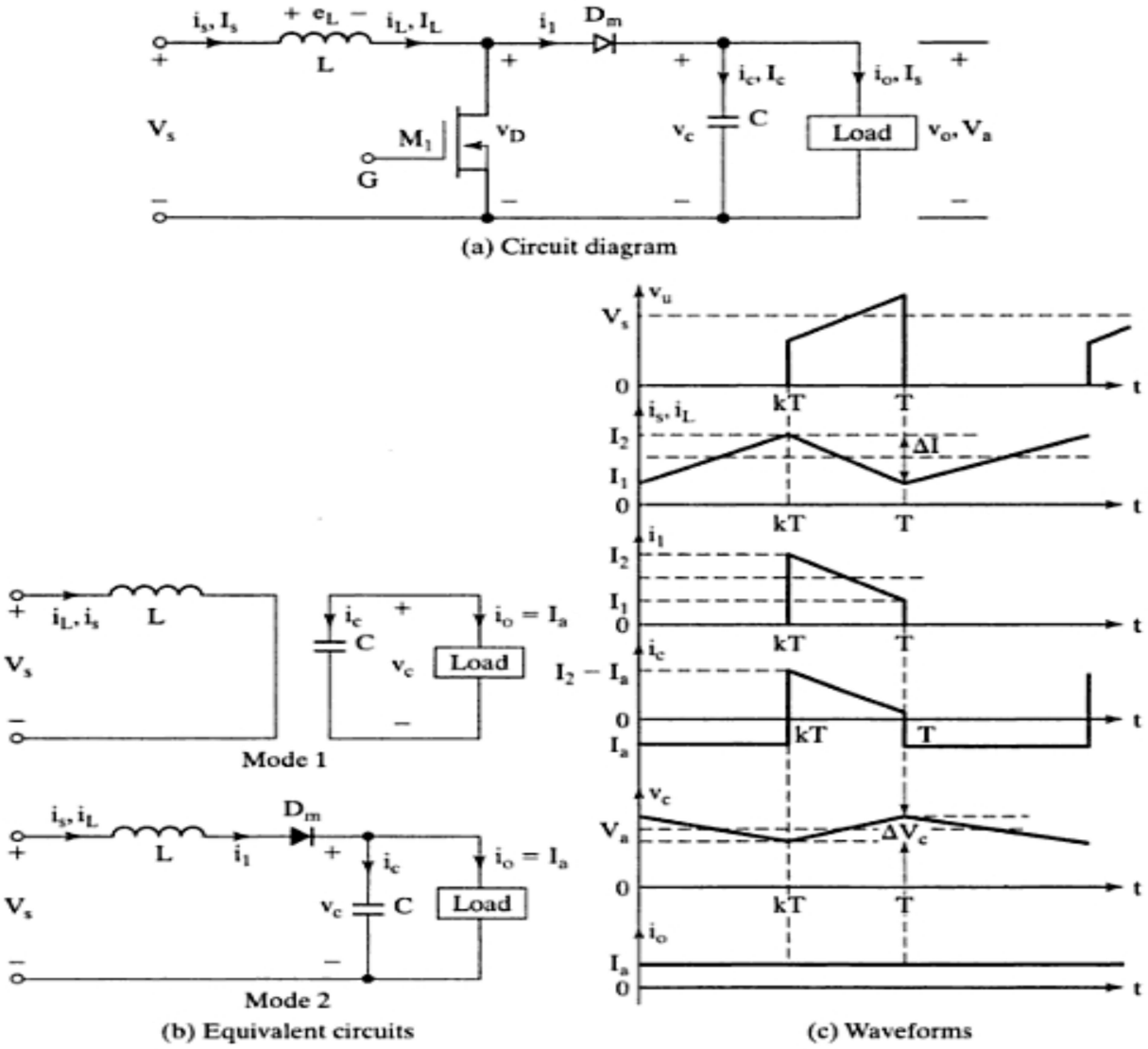
(ii)During +ve half cycle, T1 is forward biased and from α to ∏ it starts conducting. During 0 to α $V_{T1}=e_s$. From α to ∏ when T_1 conducts its voltage drop is 1 volt. From ∏ to (∏+α) it is reverse biased so $V_{T1}=e_s$.

(iii)During –ve half cycle T_2 is forward biased and it starts conducting from (∏+α) to 2∏.From ∏ to (∏+α) it $V_{T2}=e_s$.From (∏+α) to 2∏ its voltage drop is 1 volt.

Q(2) Explain the working of boost converter.(2013)(bp)

Ans: (i) In this type of converter, the output voltage is greater than input voltage. When the power MOSFET is ON, the inductor stores energy during T_{on}. Hence diode D_f is reverse biased and isolates the output stage.

(ii) When power mosfet is off, the output stage receives energy from the inductor as well as from the input. The current was flowing from the transistor would flow through L , D_f, C, load.



LONG QUESTIONS

Q(1)Explain buck-boost converter with its waveforms.(2018)

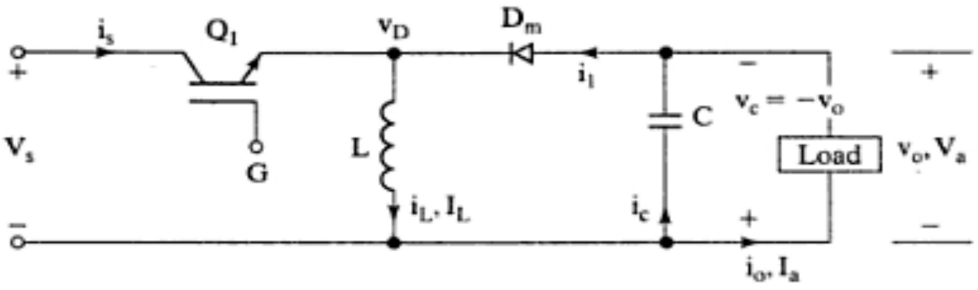
Ans: i) A buck-boost converter is a cascade connection of step-down converter and step-up converter.

(ii) When the power mosfet is switched on, the supply current flows through the path E_{dc+}-T_1-L-E_{dc-}.Hence the inductor L stores the energy during T_{on} period.

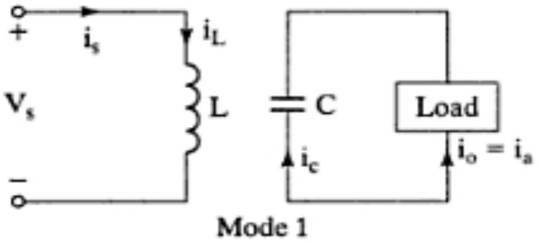
iii) When the power mosfet is switched off the inductor current tends to decrease. The polarity of the inductor gets reversed. As a result diode get

forward biased. Thus inductance energy discharge through the load through L^+-load-D-L^-.

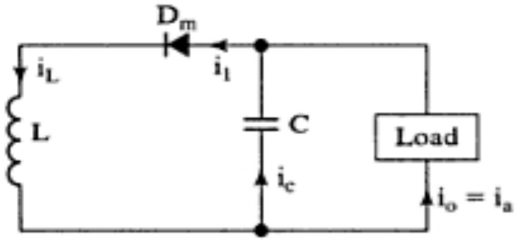
(iv) This converter has high efficiency. The inductor L limits the di /dt of the fault current when the device is under fault condition.



(a) Circuit diagram

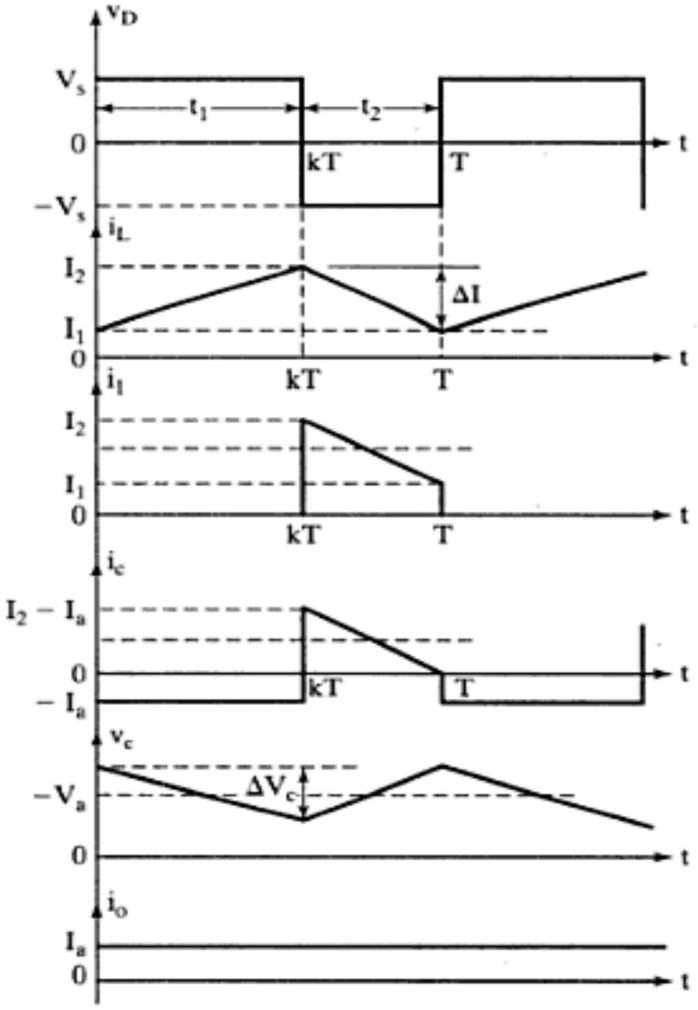


Mode 1



Mode 2

(b) Equivalent circuits



(c) Waveforms

CHAPTER-09

MEDIUM QUESTIONS

Q(1) Explain the operation of speed control of induction motor by stator voltage/frequency control method.(2014(w))(2013)(BP),2018w)

Stator Voltage and Frequency Control Method

We know that $T_{em} = \frac{3P}{4} . (\frac{V_1}{W_1})^2 \ (1 \ / \ l_1 + l_2)$

The above equation shows that if $(\frac{V_1}{W_1})$, or air gap flux Φ1 is kept constant, the maximum torque remains unaltered. So the staring torque increases even if air gap flux is kept constant. At low values of frequencies the magnitude of maximum torque reduces so supply voltage is increased to maintain the level of maximum torque. This method of speed control is called volts / hertz control.

From the equation it is seen that speed of the drive can be controlled by varying both voltage & frequency below their rated values. The control both voltage & frequency can be carried out through the use of 3 Φ inverter or cycloconverter. Inverters are used in low & medium power drives where as cycloconvertes are suitable for high power drive.

LONG QUESTIONS

Q(1)Explain 1-Φ full CONVERTER dc drive with circuit diagram.(2015(w))

1-Φ full CONVERTER dc drive

Two full converters , one feeding the armature circuit & other feeding the field circuit of separately excited DC motor as shown in the figure,

It is a two quadrant drive. Its use is limited to 15 KW. For regenerative braking of the motor the power most flow from motor to AC source and this is feasible only if motor counter emf is reversed because then $e_a \ I_a$ would be negative this is possible by reversing the direction of motor field current making an delay angle of full converter to than 90˚. In order that current in field winding can be reversed, the field winding must be energized through single phase full converter.

Q(2) Explain the armature voltage control method for dc motor with neat circuit diagram.(2014(w)).

Ans:-Armature Voltage Control Method:-

In this method speed below rated speed can be obtained .We know that the speed in dc motor directly depends on supply voltage .In this method field current and armature current are kept constant .So armature voltage control method is also called constant torque drive Method.

Armature Voltage Control

This method of speed control needs a variable source of voltage separated from the source supplying the field current. This method avoids disadvantages of poor speed regulation and low efficiency of armature-resistance control methods. The basic adjustable armature voltage control method of speed d control is accomplished by means of an adjustable voltage

Generator is called Ward Leonard system. This method involves using a motor – generator (M-G) set. This method is best suited for steel rolling mills, paper machines, elevators, mine hoists, etc. Advantages

1. Very fine speed control over whole range in both directions
2. Uniform acceleration is obtained
3. Good speed regulation

Disadvantages

1. Costly arrangement is needed , floor space required is more
2. Low efficiency at light loads