SHREE DATTEA POLYTECHNIC COLLAGE, DATTANAGER, SHIROL.

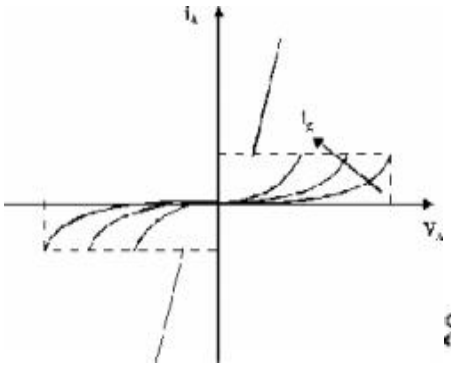
CLASS TEST -01 modal answer

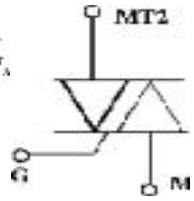
Subject- PED **Time-** 1HR

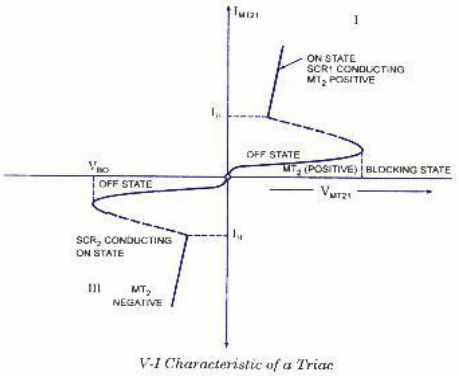
Subject Code- 12232 **Marks-** 25

Q1. Attempt any three 09

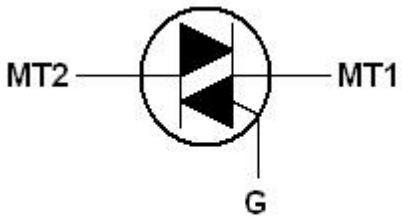
a) Draw a symbol and V-I characteristics of SCR and TRIAC





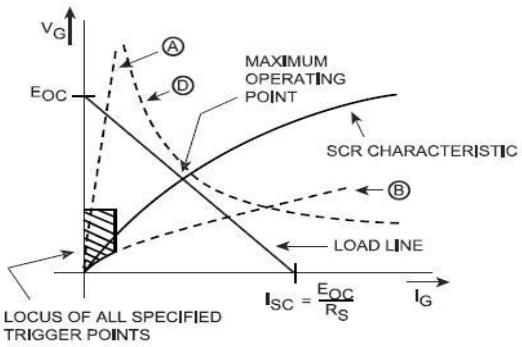


V-I Characteristic of a Triac



Triac Symbol

b) Draw and explain D.C. gate characteristics.



Gate characteristics is graph of Vg and Ig. i.e. forward gate voltage and gate current dc values. As the gate cathode junction is a PN junction, the characteristics are same as that of a diode. For a particular type of SCRs, Vg-Ig characteristics is spread between two curves A and B. Curve D represents the Pgav curve. The operating point is the intersection of gate circuit source line and the thyristor characteristics. The intersection should be as close to Pgav curve and lie within A and B for reliable turn ON of thyristor.,

c) List and explain any six specifications of thyristor.

CURRENT RATINGS OF SCR

- Surge Current Rating (IFM)—The surge current rating (IFM) of an SCR is the peak anode current an SCR can handle for a short duration.
- Latching Current (IL)—A minimum anode current must flow through the SCR in order for it to stay ON initially after the gate signal is removed. This current is called the latching current (IL).
- Holding Current (IH)—After the SCR is latched on, a certain minimum value of anode current is needed to maintain conduction. If the anode current is reduced below this minimum value, the SCR will turn OFF.

VOLTAGE RATINGS OF SCR

- Peak Repetitive Reverse Voltage (VRRM)—The maximum instantaneous voltage that an SCR can withstand, without breakdown, in the reverse direction.
- Peak Repetitive Forward Blocking Voltage (VDRM)—The maximum instantaneous voltage that the SCR can block in the forward direction. If the VDRM rating is exceeded, the SCR will conduct without a gate voltage.
- No repetitive Peak Reverse Voltage (VRSM)—The maximum transient reverse voltage that the SCR can withstand.
- Maximum Gate Trigger Current (IGTM)—The maximum DC gate current allowed to turn the SCR ON.

d) Define following terms:

i) Firing angle:- it is defined as an angle between the instant at which the thyristor would conduct firing angle my be measured with respect to given reference at which the firing pulse are given to scr

ii) Extension angle:- it is defined as the angle measured from the reference point to the instant at with the current extinguishes to zero

e) What is free-wheeling diode? State its advantages.
Freewheeling diode is commutating device because it transfers the load current away from the rectifier ckt this is also know as bypass diode.
Advantages of freewheeling diode.
1) load current wave form is improved
2) it prevent negative voltage swing
3) it is with RL load is identical equal to R load
4) it improves the input power factor of the system

Q2. Attempt any two 08

a) List and explain any six specifications of thyristor.

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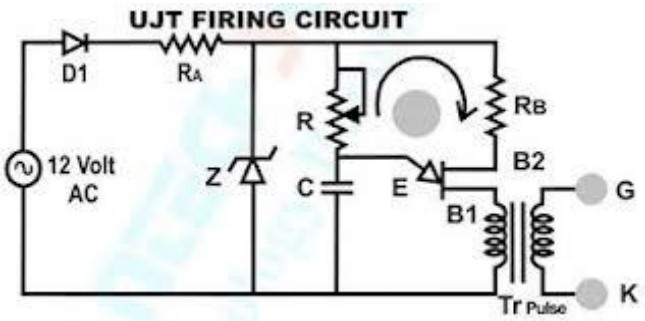
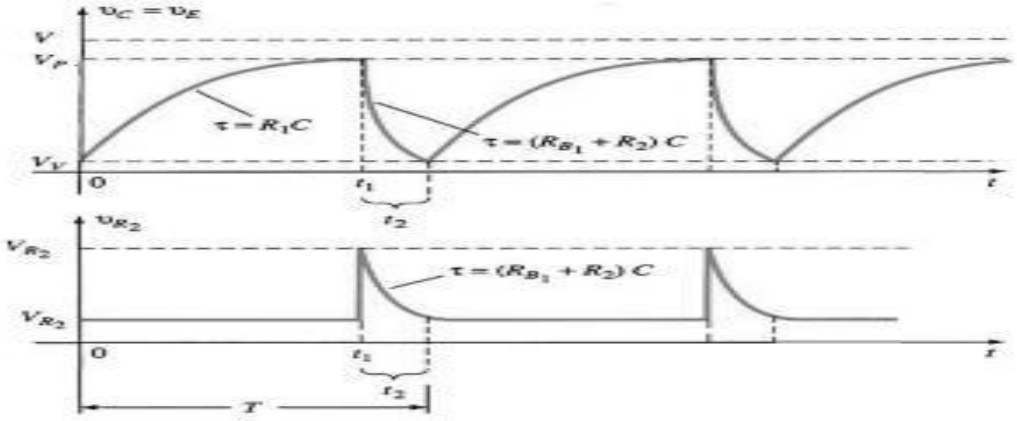
b) With the help of circuit explain UJT triggering method.



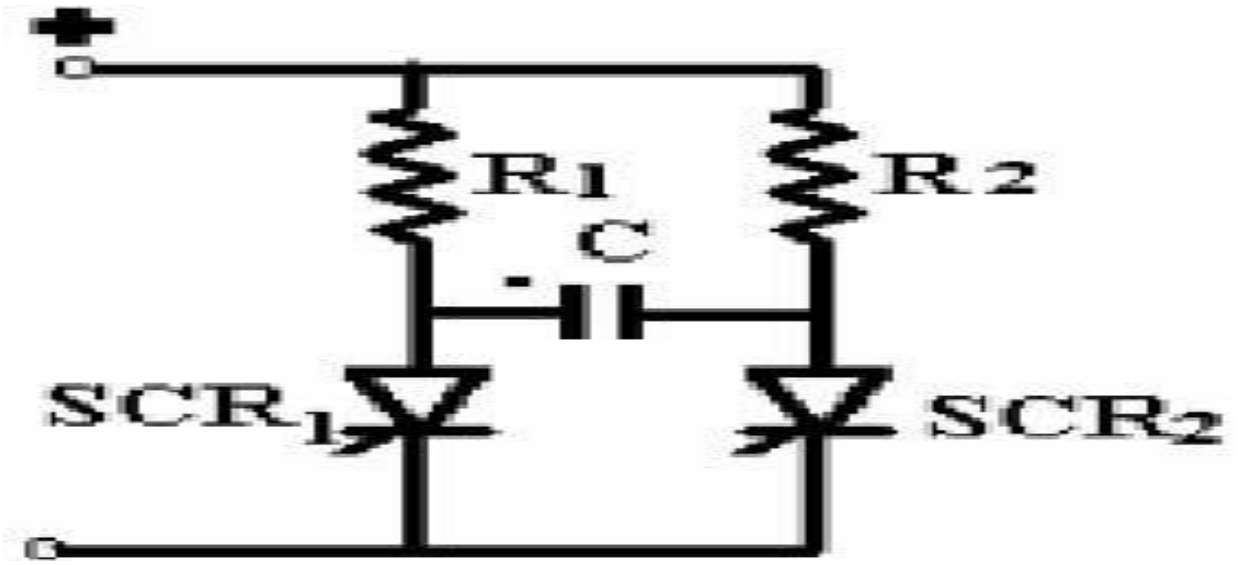
The UJT is commonly used as a triggering SCR. The SCR shown is triggered when the UJT emitter circuit conducts. As the capacitor charges, VE increases. When it reaches VP, the UJT fires. The voltage developed across R2 triggers the SCR.



c) Explain how SCR can be turned off naturally. Discuss the classification of commutation and explain **class C** commutation in detail.

The process of turning off a thyristor without using any external circuits is known as Natural commutation. This type of commutation is only possible in AC Applications. When using A.C. Supply, the current passing through the device is alternating. This alternating current go to peak positive value , passes through its zero and then go through peak negative value. When the alternating quantity at zero then the current passing through the device also zero and at same time a reverse polarity develops across the thyristor. This will quickly Turn OFF the thyristor. This process of commutation is known as Natural Commutation as no external circuits or components are used.

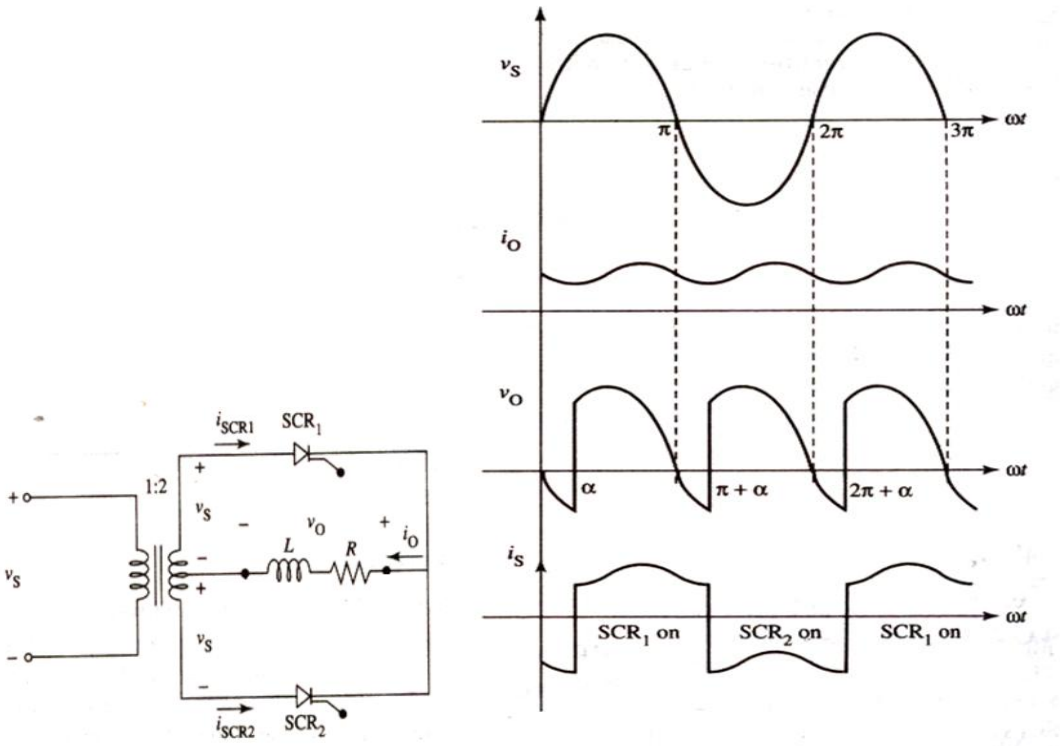
Class c commutation:- The process of turning OFF a thyristor or SCR by using external circuits is known as Forced Commutation. This method of commutation is used for D.C. Commutation.



This configuration has two **SCRs**. One of them may be the main **SCR** and the other auxiliary. Both may be load current carrying main **SCRs**. The configuration may have four **SCRs** with the load across the capacitor, with the integral converter supplied from a current source. Assume SCR2 is conducting. C then charges up in the polarity shown. When **SCR**1 is triggered, C is switched across **SCR**2 via **SCR**1 and the discharge current of C opposes the flow of load current in **SCR**2.

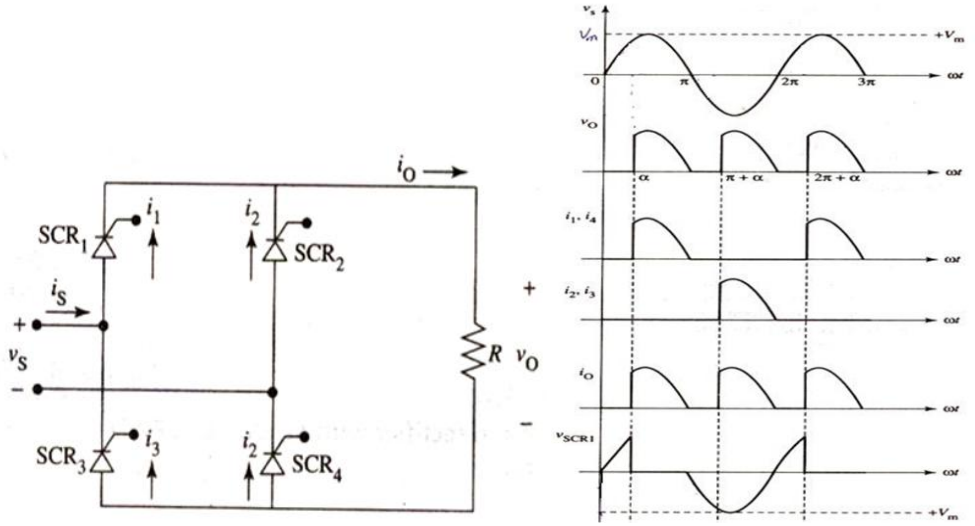
Q3. Attempt any two 08

a) With neat circuit diagram and waveform explain the operation of single phase full wave controlled rectifier with RL load.



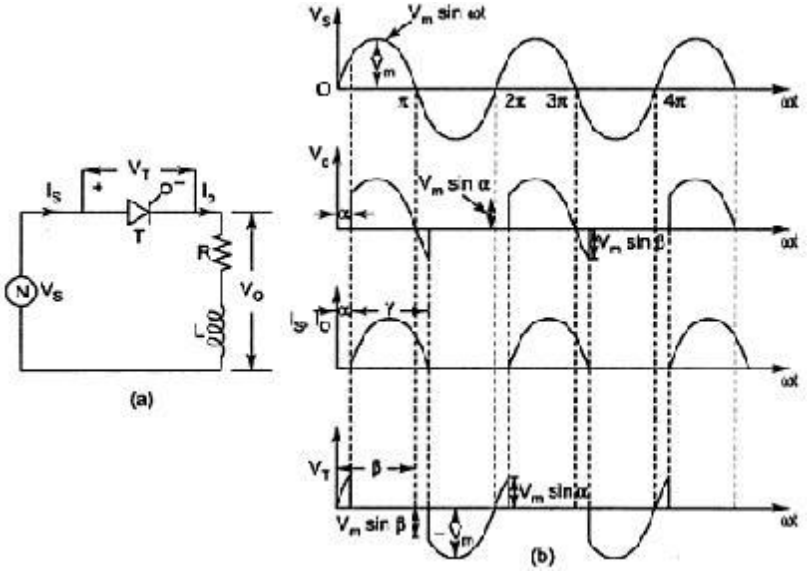
During positive-half cycle of source voltage, SCR1 is forward biased and SCR2 is reverse biased. When firing angle is given to the scr 1 it starts the delivering voltage and current to the load from wt=α to β scr 1 is not turn off at wt= π due to presence of inductor in load side. During negative half-cycle, SCR2 is forward biased and SCR1 is reverse biased. When firing angle is given to the scr 2 it starts the delivering voltage and current to the load from wt=β to 2π + α scr 1 is not turn off at wt= 2π due to presence of inductor in load side.

b) With neat circuit diagram and waveform explain the operation of single phase full wave bridge controlled rectifier with R load.



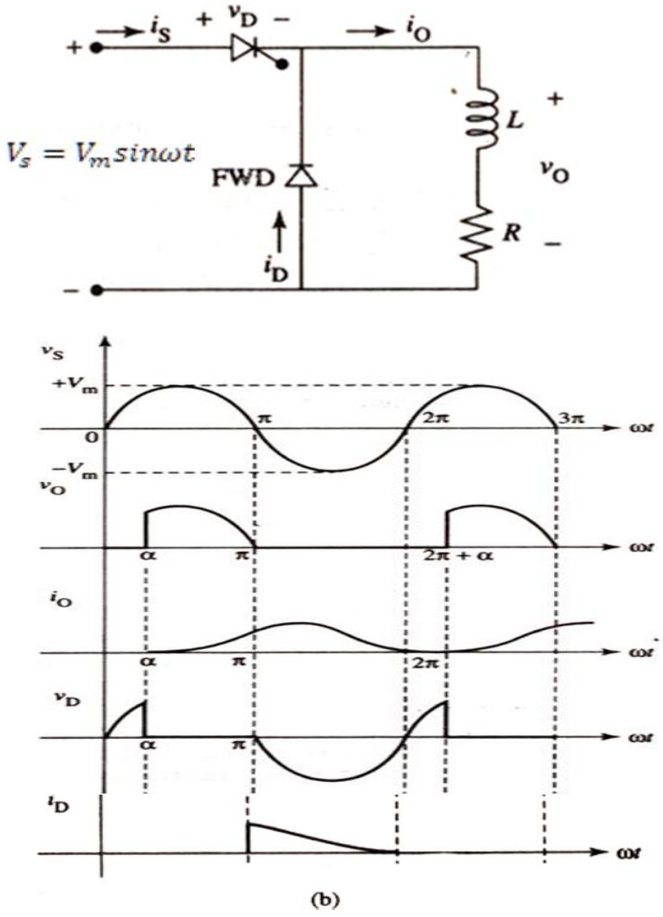
During positive-half cycle of source voltage, SCR1 and SCR 2 is forward biased and SCR3 and SCR 4 is reverse biased. When firing angle is given to the SCR1 and SCR 2 it starts the delivering voltage and current to the load from wt=α to π SCR1 and SCR 2 is turn off at wt= π. During negative half-cycle SCR3 and SCR 4 is forward biased and SCR1 and SCR 2 is reverse biased. When firing angle is given to the SCR3 and SCR 4 it starts the delivering voltage and current to the load from wt=β to 2π SCR3 and SCR 4 is turn off at wt= 2π

c) With neat circuit diagram and waveform explain the operation of single phase half wave controlled rectifier with RL load and free-wheeling diode.



The above figure shows operation of half converter with RL load. As it can be seen that thyrsitor continues to conduct after wt=π as the current has not become zero. This is because there is stored energy in the inductance. This causes drop in the average output voltage as it has a

negative going period after wt= π . If the inductance is large, trigger circuit loses it control on the thyristor. This situation is overcome by forcibly turning off the thyristor at wt= π. This can be achieved by connecting a diode across load which is called as a freewheeling diode. Which is shown in the fig. below.



(b)

When supply voltage tends to reverse, it will forward bias the freewheeling diode and the load voltage will be zero at wt= π.