1st CLASS TEST

EE - 310
Energy Management

Q1. ઉર્જા પ્રબંધન કે ચાર સિદ્ધાંત લિખિયે

Ans. ઉર્જા પ્રબંધન કે ચાર સિદ્ધાંત નિમ્ન લિખિત હૈં

(i) સભી જરૂરત મંદોં કો સંભાવિત ન્યૂનતમ દર પર ઉર્જા ઉપલબ્ધ કરાના
(ii) ઉર્જા ઉપયોગ કી અધિકતમ દક્ષતા કા પ્રબંધન કરના
(iii) ઉર્જા કી રિસાઇકલિંગ એવં પુનઃ ઉપયોગ કે મકેનિઝમ કે દ્વારા કરના
(iv) સબસે ઉત્તમ તકનીક કા ઉપયોગ કરના
(v) હાનિયોં કો ન્યૂનતમ કરના (vi) પર્યાવરણ પ્રદૂષણ કો કમ કરના
(vii) આર્થિક વિશ્લેષણ

Q2. ઉર્જા પ્રબંધન કે ઉદ્દેશ્ય લિખિયે.

Ans ઉર્જા પ્રબંધન કા અર્થ અધિકતમ ફાયદે કે લિયે ઉર્જા કા પ્રભાવી ઢંગ સે ઉપયોગ કરના હૈં ઇસકા અર્થ બેકાર વસ્તુ કો અલગ કર ઉર્જા કા સ્ટોરેજ વિધિ સે ઉપયોગ કરના જિસમે ન્યૂનતમ હાનિ હો

ઉર્જા પ્રબંધન કે ઉદ્દેશ્ય નિમ્ન લિખિત હૈં

(i) ઉત્પાદન ઔર ગુણવત્તા કો પ્રભાવિત કરે બિના ઉર્જા મૂલ્ય કી વર્તમાન કો ન્યૂનતમ કરના
(ii) પર્યાવરણ કે પ્રભાવ ઔર પરિસ્થિતિ કો ન્યૂનતમ કરના :- ઉર્જા તથા પર્યાવરણ મેં સંતુલન નિમ્ન પ્રકાર કિયા જા સકતા હૈ

(a) ઉર્જા કા ઉપયોગ કમ કરો :- જૈસે સર્વોત્તમ પરિવહન પ્રણાલી કા ઉપયોગ કર પર્યાવરણ કો સુરક્ષિત કિયા જા સકતા હૈં.

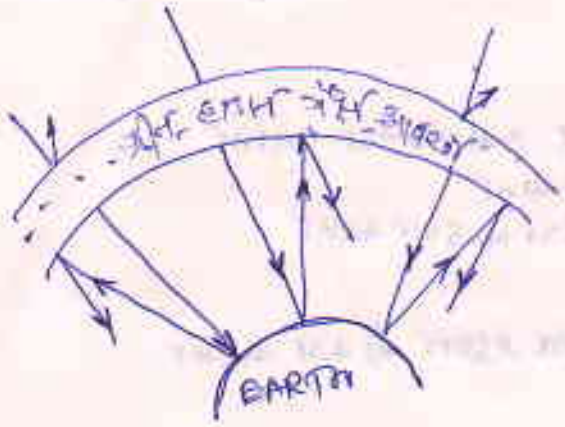
(b) વિવેક નીતિ બનાકર :- ગ્રીન હાઉસ પ્રભાવ કો કમ કરને મેં પ્રયુક્ત ઉપકરણોં પર ટેક્સ કમ કરકે ઉર્જા મેં સંતુલન બનાયા જા સકતા હૈં

(c) ન્યૂનતમ કાર્બન ટેક્નોલોજી કે પ્રચાર વ પ્રસારકો પ્રોત્સાહિત કરો

(iii) ઉર્જા નિર્ગત પ્રતિ ઇકાઈ કે લિયે ઇંધન કી આવશ્યકતા કો કમ કરના
(iv) સભી વિધિયોં, સંગઠનોં મેં કઠિનાઈ સે પ્રાપ્ત હોને વાલી ઉર્જા કા યથા સંભવ સર્વોત્તમ ઉપયોગ કરના
(v) માંગ કી આવશ્યકતા અનુસાર લઘુ મધ્યમ વ લંબી અવધિકી યોજના સ્થાપિત કરના
(vi) ઉર્જા સંરક્ષણ કે લિએ પ્રોત્સાહન

Q3. ગ્રીન હાઉસ પ્રભાવ કો સમઝાઇયે।

Ans. સૂર્ય સે પૃથ્વી કી ઓર આને વાલી અધિકાંશ કિરણે પૃથ્વી કી સતહ પર પહુંચકર સતહ કો ગર્મ કરતી હૈં। ગર્મ સતહ સે ઉત્સર્જ પુનઃ અંતરિક્ષ મેં લૌટતા હૈં, પરંતુ માર્ગ મેં આને વાલે કુછ ગૈસો કે આવરણ કે કારણ ઇસકા પુનઃ પૃથ્વી કી ઓર પરાવર્તન હોજાતા હૈં ઇસ કારણ સે ધીરે-ધીરે પૃથ્વી કે તાપમાન મેં વૃદ્ધિ હોતી હૈ ઔર ઉક્ત પ્રાકૃતિક પ્રક્રિયા કો ગ્રીન હાઉસ પ્રભાવ કહા જાતા હૈં



पृथ्वी का जलवायु को अनुकूल बनाने के लिये ग्रीन हाउस गैसें महत्वपूर्ण योगदान है

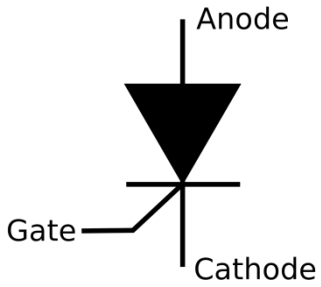
ग्रीन हाउस गैस	ग्लोबल वार्मिंग में योगदान
कार्बन डाइ ऑक्साइड	55%
क्लोरो फ्लोरो कार्बन	24%
मेथेन	15%
नाइट्रस ऑक्साइड	6%

तापमान वृद्धि का पर्यावरणीय प्रभाव

(a) ध्रुवों की बर्फ का पिघलना
(b) चक्रवात और तुफान
(c) भूकम्प एवं ज्वालामुखी
(d) ग्लेशियरों का पिघलना

SGBB GOVT. POLYTECHNIC COLLEGE, SIROHI
Subject: EL305/EE301 Power Electronics

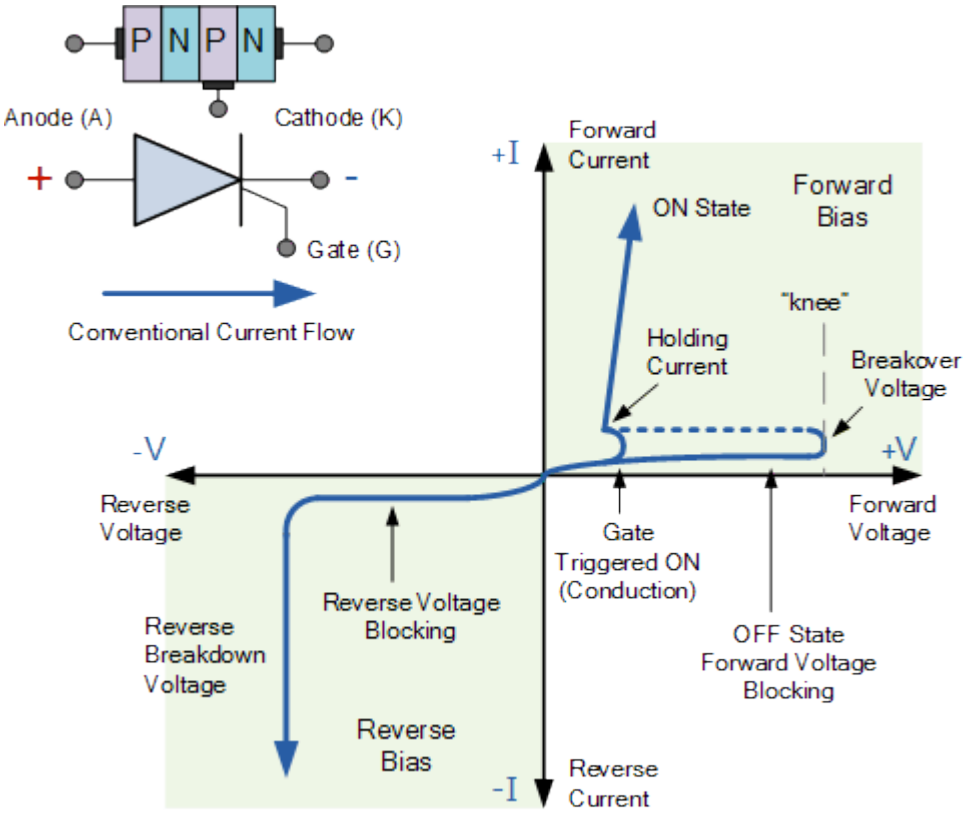
Q-1 Draw the symbol of SCR. Explain its working and charactertristic curve with the help of diagram.



The silicon control rectifier (SCR) consists of four layers of semiconductors, which form **NPNP** or **PNPN** structures, having three P-N junctions labeled **J1**, **J2** and **J3**, and three terminals. The anode terminal of an SCR is connected to the p-type material of a PNPN structure, and the cathode terminal is connected to the n-type layer, while the gate of the SCR is connected to the p-type material nearest to the cathode.

An SCR consists of four layers of alternating p- and n-type semiconductor materials. Silicon is used as the intrinsic semiconductor, to which the proper dopants are added. The junctions are either diffused or alloyed (alloy is a mixed semiconductor or a mixed metal). The planar construction is used for low-power SCRs (and all the junctions are diffused). The mesa-type construction is used for high-power SCRs. In this case, junction J2 is obtained by the diffusion method, and then the outer two layers are alloyed to it, since the PNPN pellet is required to handle large currents. It is properly braced with tungsten or molybdenum plates to provide greater mechanical strength. One of these plates is hard-soldered to a copper stud, which is threaded for attachment of heat sink. The doping of PNPN depends on the application of SCR, since its characteristics are similar to those of the thyristor. Today, the term "thyristor" applies to the larger family of multilayer devices that exhibit bistable state-change behaviour, that is, switching either on or off.

Thyristor I-V Characteristics Curves



Once the thyristor has been turned "ON" and is passing current in the forward direction (anode positive), the gate signal looses all control due to the regenerative latching action of the two internal transistors. The application of any gate signals or pulses after regeneration is initiated will have no effect at all because the thyristor is already conducting and fully-ON.

Unlike the transistor, the SCR can not be biased to stay within some active region along a load line between its blocking and saturation states. The magnitude and duration of the gate "turn-on" pulse has little effect on the operation of the device since conduction is controlled internally. Then applying a momentary gate pulse to the device is enough to cause it to conduct and will remain permanently "ON" even if the gate signal is completely removed.

Q-2 Write construction, working and characteristics of TRIAC.

Triac is a three terminal AC switch which is different from the other silicon controlled rectifiers in the sense that it can conduct in both the directions that is whether the applied gate signal is positive or negative, it will conduct. Thus, this device can be used for AC systems as a switch. This is a three terminal, four layer, bi-directional semiconductor device that controls AC power. The triac of maximum rating of 16 kw is available in the market.

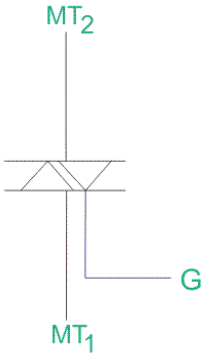


Figure shows the symbol of triac,

which has two main terminals MT_1 and MT_2 connected in inverse parallel and a gate terminal.

Construction

Two SCRs are connected in inverse parallel with gate terminal as common. Gate terminals is connected to both the N and P regions due to which gate signal may be applied which is irrespective of the polarity of the signal. Here, we do not have anode and cathode since it works for both the polarities which means that device is bilateral. It consists of three terminals namely, main terminal 1(MT_1), main terminal 2(MT_2), and gate terminal G.

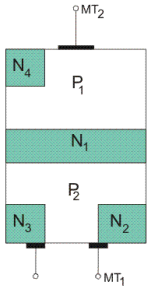


Figure shows the construction of a triac.

There are two main terminals namely MT_1 and $MT_2$and the remaining terminal is gate terminal.

Operation:

The triac can be turned on by applying the gate voltage higher than break over voltage. However, without making the voltage high, it can be turned on by applying the gate pulse of 35 micro seconds to turn it on. When the voltage applied is less than the break over voltage, we use gate triggering method to turn it on.
There are four different modes of operations, they are-

1. **When MT_2 and Gate being Positive with Respect to MT_1** When this happens, current flows through the path P_1-N_1-P_2-N_2. Here, P_1-N_1 and P_2-N_2 are forward biased but N_1-P_2 is reverse biased. The triac is said to be operated in positively biased region. Positive gate with respect to MT_1 forward biases P_2-N_2 and breakdown occurs.
2. **When MT_2 is Positive but Gate is Negative with Respect to MT_1** The current flows through the path P_1-N_1-P_2-N_2. But P_2-N_3 is forward biased and current carriers injected into P_2 on the triac.
3. **When MT_2 and Gate are Negative with Respect to MT_1** Current flows through the path P_2-N_1-P_1-N_4. Two junctions P_2-N_1 and P_1-N_4 are forward biased but the junction N1-P1 is reverse biased. The triac is said to be in the negatively biased region.
4. **When MT_2 is Negative but Gate is Positive with Respect to MT_1** P_2-N_2 is forward biased at that condition. Current carriers are injected so the triac turns on. This mode of operation has a disadvantage that it should not be used for high (di/dt) circuits. Sensitivity of triggering in mode 2 and 3 is high and if marginal triggering capability is required, negative gate pulses should be used. Triggering in mode 1 is more sensitive than mode 2 and mode 3.

Characteristics of a Triac

The **triac** characteristics is similar to SCR but it is applicable to both positive and negative triac voltages. The operation can be summarized as follows-

First Quadrant Operation of Triac

Voltage at terminal MT_2 is positive with respect to terminal MT_1 and gate voltage is also positive with respect to first terminal.

Second Quadrant Operation of Triac

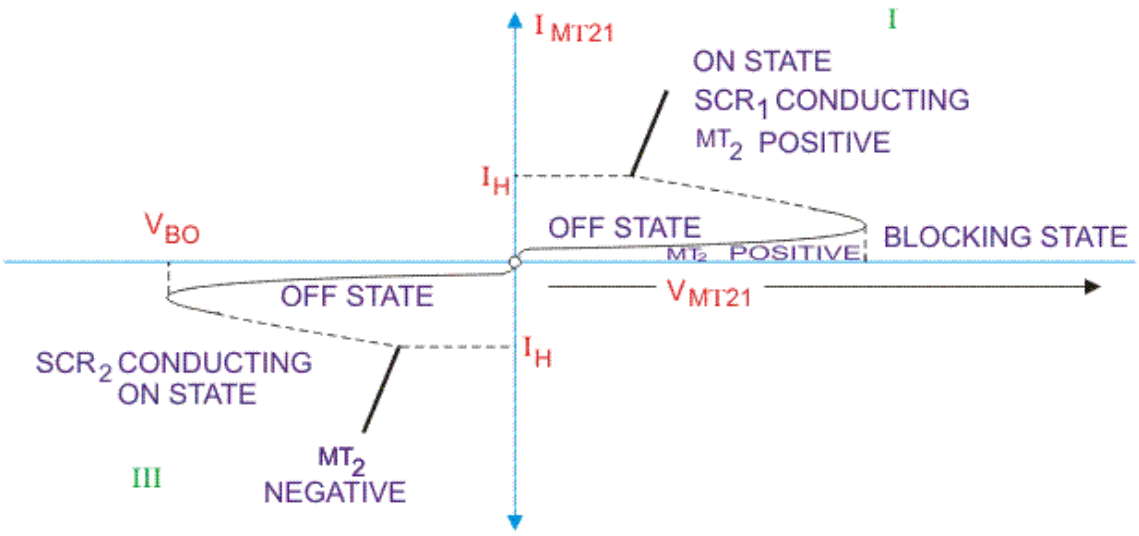
Voltage at terminal 2 is positive with respect to terminal 1 and gate voltage is negative with respect to terminal 1.

Third Quadrant Operation of Triac

Voltage of terminal 1 is positive with respect to terminal 2 and the gate voltage is negative.

Fourth Quadrant Operation of Triac

Voltage of terminal 2 is negative with respect to terminal 1 and gate voltage is positive.

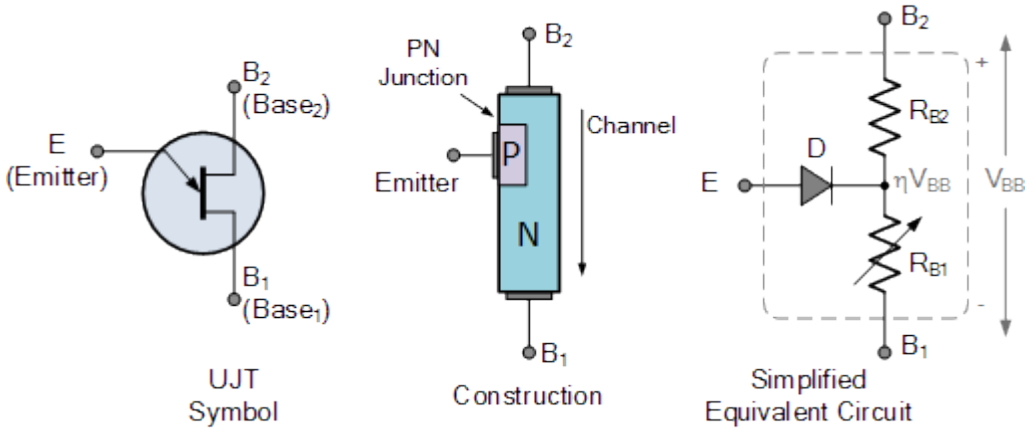


V-I Characteristic of a Triac

When the device gets turned on, a heavy current flows through it which may damage the device, hence in order to limit the current a current limiting resistor should be connected externally to it. By applying proper gate signal, firing angle of the device may be controlled. The gate triggering circuits should be used for proper gate triggering. We can use diac for triggering the gate pulse. For firing of the device with proper firing angle, a gate pulse may be applied up to a duration of 35 micro seconds.

Q-3 Write construction, working and characteristics of UJT.

Construction



The UJT has three terminals: an emitter (E) and two bases (B_1 and B_2) and so is sometimes known a "double-base diode". The base is formed by a lightly doped n-type bar of silicon. Two ohmic contacts B_1 and B_2 are attached at its ends. The emitter is of p-type is heavily doped; this single PN junction gives the device its name. The resistance between B1 and B2 when the emitter is open-circuit is called *interbase resistance*. The emitter junction is usually located closer to base-2 (B2) than base-1 (B1) so that the device is not symmetrical, because a symmetrical unit does not provide optimum electrical characteristics for most of the applications.

Working:

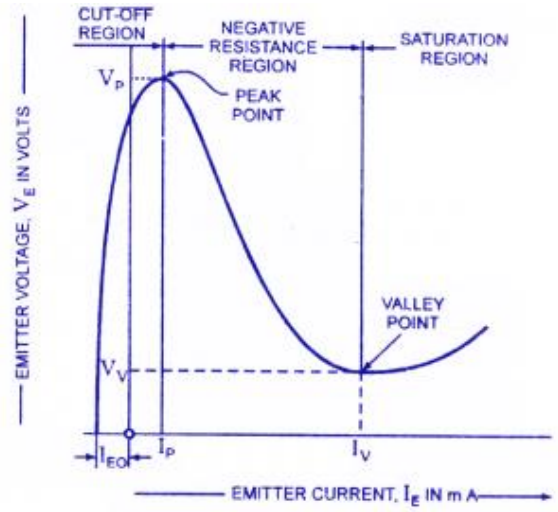
The device has a unique characteristic that when it is triggered, its emitter current increases regeneratively until it is restricted by emitter power supply. It exhibits a negative resistance characteristic and so it can be employed as an oscillator.

The UJT is biased with a positive voltage between the two bases. This causes a potential drop along the length of the device. When the emitter voltage is driven approximately one diode voltage above the voltage at the point where the P diffusion (emitter) is, current will begin to flow from the emitter into the base region. Because the base region is very lightly doped, the additional current (actually charges in the base region) causes conductivity modulation which reduces the resistance of the portion of the base between the emitter junction and the B2 terminal. This reduction in resistance means that the emitter junction is more forward biased, and so even more current is injected. Overall, the effect is a negative resistance at the emitter terminal. This is what makes the UJT useful, especially in simple oscillator circuits.

.Characteristics:

The static emitter characteristic (a curve showing the relation between emitter voltage V_E and emitter current I_E) of a **UJT** at a given inter base voltage V_{BB} is shown in figure. From figure it is noted that for emitter potentials to the left of peak point, emitter current I_E never exceeds I_{Eo} .

The current I_{Eo} corresponds very closely to the reverse leakage current I_{Co} of the conventional BJT. This region, as shown in the figure, is called the cut-off region. Once conduction is established at $V_E = V_P$ the emitter potential V_E starts decreasing with the increase in emitter current I_E. This Corresponds exactly with the decrease in resistance R_B for increasing current I_E.



Static Emitter-Characteristic For a UJT

This device, therefore, has a negative resistance region which is stable enough to be used with a great deal of reliability in the areas of applications listed earlier. Eventually, the valley point reaches, and any further increase in emitter current I_E places the device in the saturation region, as shown in the figure. Three other important parameters for the UJT are I_P, V_V and I_V and are defined below:

Peak-Point Emitter Current. I_p. It is the emitter current at the peak point. It represents the rnimrnum current that is required to trigger the device (UJT). It is inversely proportional to the interbase voltage V_{BB}.

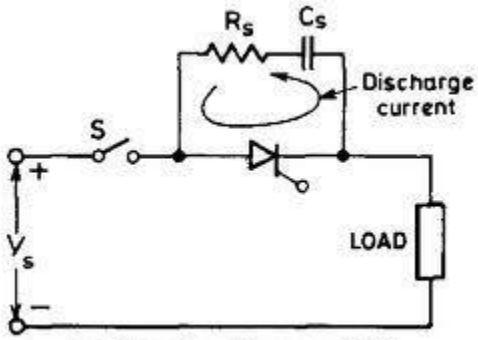
Valley Point Voltage V_V The valley point voltage is the emitter voltage at the valley point. The valley voltage increases with the increase in interbase voltage V_{BB}.

Valley Point Current I_V The valley point current is the emitter current at the valley point. It increases with the increase in inter-base voltage V_{BB}.

Q-4 Short Notes:

(a) Snubber Circuit:

Snubber circuits are needed to limit the rate of change in voltage or current (di/dt or dv/dt) and over voltage during turn-on and turn-off. These are placed across the semiconductor devices for protection as well as to improve the performance. Static dv/dt is a measure of the ability of a thyristor to retain a blocking state under the influence of a voltage transient. These are also used across the relays and switches to prevent arcing.



Snubber circuit across SCR.

Snubbers are frequently used in electrical systems with an inductive load where the sudden interruption of current flow leads to a sharp rise in voltage across the current switching device, in accordance with Faraday's law. This transient can be a source of electromagnetic interference (EMI) in other circuits. Additionally, if the voltage generated across the device is beyond what the device is intended to tolerate, it may damage or destroy it. The snubber provides a short-term alternative current path around the current switching device so that the inductive element may be discharged more safely and quietly. Inductive elements are often unintentional, but arise from the current loops implied by physical circuitry. While current switching is everywhere, snubbers will generally only be required where a major current path is switched, such as in power supplies.

(b) Holding and Latching Current

HOLDING CURRENT:

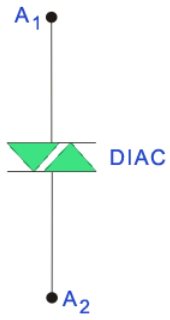
The minimum value of current that must be there to provide a path between anode and cathode to flow anode current and thus maintain a thyristor in the on state.

LATCHING CURRENT:

The minimum anode current required to maintain a thyristor in on-state immediately after a thyristor has be triggered on. IL>IH rate of flow of charge is known as current.

(c) DIAC

Diac is a device which has two electrodes. It is a member of the thyristor family. It is mainly used in triggering of thyristor. The advantage of using this device is that it can be turned on or off simply by reducing the voltage level below its avalanche breakdown voltage. Also, it can be either turned on or off for both the polarity of voltages. This device works when avalanche breakdown occurs.



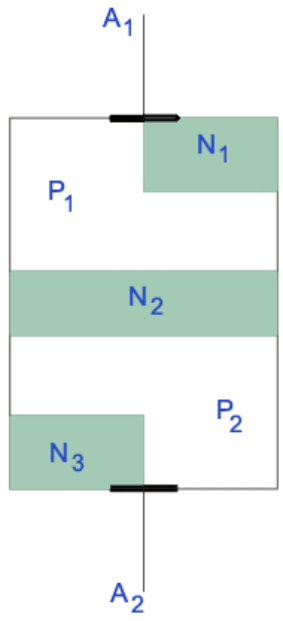
Diac Symbol

The figure shows a symbol of diac which resembles the connection of two diodes in series. Also it can be called as a transistor without base.

Construction of Diac

It is a device which consists of four layers and two terminals. The construction is almost same as that of the transistor. But there are certain points which deviate from the construction from the transistor. The differentiating points are-

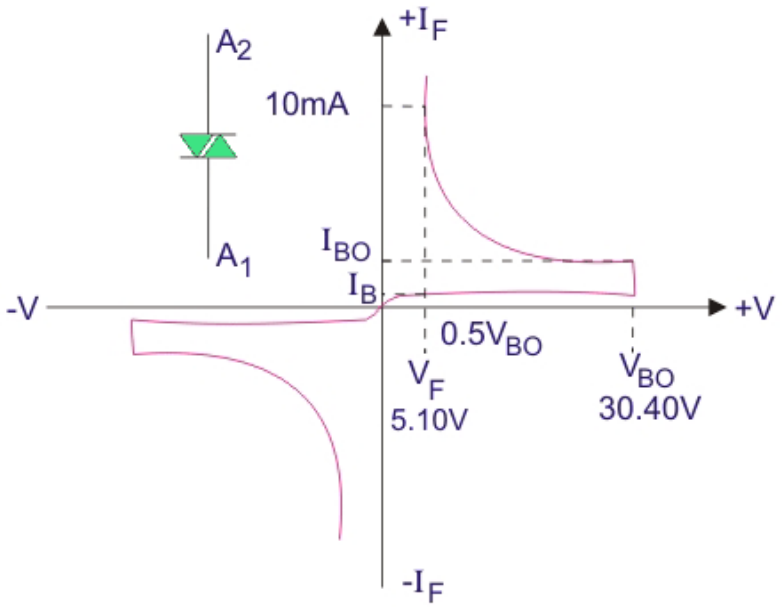
1. There is no base terminal in the diac.
2. The three regions have almost the same level of doping.
3. It gives symmetrical switching characteristics for either polarity of voltages.



Construction of Diac

Operation of Diac

From the figure, we see that it has two p-type material and three n-type materials. Also it does not have any gate terminal in it.
The **diac** can be turned on for both the polarity of voltages. When A_2 is more positive with respect to A_1 then the current does not flows through the corresponding N-layer but flows from P_2-N_2-P_1-N_1. When A_1 is more positive A_2 then the current flows through P_1-N_2-P_2-N_3. The construction resembles the diode connected in series. When applied voltage is small in either polarity, a very small current flows which is known as leakage current because of drift of electrons and holes in the depletion region. Although a small current flows, but it is not sufficient enough to produce avalanche breakdown so the device remains in the non conducting state. When the applied voltage in either polarity exceeds the breakdown voltage, diac current rises and the device conducts in accordance with its V-I characteristics.



V-I Characteristics of the Diac

The V-I characteristics resembles the english word Z. The diac acts as open circuit when the voltage is less than its avalanche breakdown voltage. When the device has to be turned off, the voltage must be reduced below its avalanche breakdown voltage.

EE-303 Estimating costing & Design of electrical Installation

I st test - 2017

Q1. Write names of different types of wires used in electric wiring and their uses.
विद्युत वायरिंग में काम में आने वाले विभिन्न तारों के नाम व उनका उपयोग लिखिए।

उत्तर → (i) वी० आर० आर० तार (V.I.R. wire): अनकवित आरतीय रबड तार: यह चालक तार को भारतीय रबड से विद्युतरोधित या आवरित किया जाता है। तारों को नमी के प्रभाव से बचाने के लिए रबर के ऊपर नमी रोकने वाला विटुमन द्रव या अन्य किसी विद्युतरोधी पदार्थ के साथ सुती टेप रबड के ऊपर कोल (sheath) के रूप में लपेटा जाता है। यह 250 से 1100 V तक प्रयोग किया जाता है

(ii) सी० टी० एस० या टी० आर० एस० (CTS or TRS wire) → Tough rubber sheated तारे वैटन वायरिंग में प्रयोग की जाती है। चालक पर रबड का विद्युतरोधन किया जाता है। ऊपर की परत नमी से भी इसकी सुरक्षा करती है।

(iii) P.V.C. पी० वी० सी० तार :- इस प्रकार की तारों में चालकों को पॉलिविनाइल क्लोराइड कम्पाउण्ड से विद्युतरोधित किया जाता है। पी. वी. सी. विद्युत रोधन रबड से सस्ता होता है इसलिए यांत्रिक तथा नमी से बचाव के लिए इस पर सुती वैटिंग की आवश्यकता नहीं होती है।

(iv) लैड कोशित या धातु कोशित तारे :- इस प्रकार की तारों का बाहरी हिस्सा लैड या अन्य किसी भिन्न धातु से कोशित रहता है। इन तारों की बनावट वहा तक कोड वाले भाग के समतल्य होती है। टी. आर. एस. तारों के समान होती है। इस प्रकार की तारें छत पड़ने वाले स्थानों तथा अधिक नमी वाले स्थानों पर प्रयोग की जाती हैं।

(v) अचल-सह तारे :- इन तारो के चालक को पहले रबर और उसके बाद सुती टेप से टेपिंग करके विद्युत रोधित किया जाता है। यह सुती टेप से टेपिंग करके विद्युत रोधित किया जाता है।

(vi) नम्य तारे (Flexible wires) :- इन तारो मे नम्यता का गुण रहता है। नम्य तारो मे शुद्ध रबड़ या पी० वी० सी० (PVC) विद्युतरोधन के रूप मे प्रयोग मे किया जाता है।

Q2. मोटर को प्रारम्भ करने के लिए प्रवर्तक की आवश्यकता क्यो है।
(Why Starter is necessary for starting a motor)?

Ans:- क्योकि आर्मेचर का प्रतिरोध बहुत कम होता है। और जब आर्मेचर विराम अवस्था मे होता है। तो प्रारम्भ करते समय आर्मेचर को सीधा मुख्य तार से जोडना सुरक्षित नही रहता। इसलिए परिपथ मे कुछ प्रतिरोध लगाना आवश्यक हो जाता है। जिसे धारा के प्रथम प्रवाह को किसी सुरक्षित मान तक कम कर देना चाहिए। ज्योही मोटर अपनी चाल पकड़ ले तो उसे तुरन्त बन्द किया जा सकता है।
इस प्रकार की केवल एक युक्ति प्रवर्तक (Starter) ही हो सकती है। जिसको आर्मेचर परिपथ के साथ श्रेणी क्रम मे जोड़ा जाता है। यह हमारा उद्देश्य पूरा कर सकता है। क्योकि Starting मे मोटर मे Back emf zero होता है तो current अधिक होती है। इसलिए आर्मेचर को क्षति से बचाने के लिए Starter का उपयोग किया जाता है।

Q3. Write short note on estimating and costing & price list.

Ans :- इसकी आवश्यकता इसलिए अनिवार्य है कि ~~इसका~~ हमें इसका पुर्ण ज्ञान हो कि जिस प्रयोजना (Project) को हम प्रारम्भ करने जा रहे हैं उसके लिए कितने धन की आवश्यकता है तथा ऐसी तो कोई सामग्री नहीं, जो कि हमें कार्य करने के बाद उपलब्ध न हो सके। जब हम बिना पुर्व प्रयोजना बनाए तथा अनुमान एवं लागत निकाले किसी कार्य को प्रारम्भ कर देते हैं तो कार्य सुचारू रूप से आगे नहीं बढ़ पाता क्योंकि समय-समय पर आवश्यकतानुसार सामग्री क्रय करनी पड़ती है तथा प्राय धन की कमी के कारण कार्य को बीच में ही रोकना पड़ जाता है इसलिए किसी संस्थापन की वायरिंग करने से पुर्व उसकी पुर्व प्रयोजना बना ली जानी चाहिए तथा इसमें लगने वाली सामग्री का अनुमान एवं लागत ज्ञात कर ली जानी चाहिए जिससे हमारा कार्य बीच में रुकने न पाए।

- Price list (मुल्य सूची) :- बाजार में प्रत्येक दुकानदार अपनी सामग्री की मुल्य सूची रखता है। जिसमें उसके फुटकर (retail) तथा थोक भाव अंकित होते हैं।

→ मुल्य को केवल निर्देश के रूप में ध्यान रखते यदि सामग्री खरीदने की दिनांक पर किन्हीं कारणों से मुल्य में परिवर्तन हो तो उसी दर से मुल्य लगाया जाएगा।

→ मुल्य सूची में दी मुल्य पूर्ण रूप से दुकान पर निर्भर करती है।

Q4. Write short note on market survey and tender notice

उत्तर — Market survey (बाजार सर्वेक्षण):- संस्थान में लगने वाली सामग्री को बाजार से क्रय करना भी एक कला है इसमें पूर्व दक्षता काफी अनुभव के पश्चात आती है। तथा इसका प्रयोजना (Project) में होने वाले व्यय पर भी विशेष प्रभाव पड़ता है यदि हमें बाजार (market) से सामग्री क्रय- अनुभव नहीं हो तो दुकानदार (Shopkeeper) हमसे किसी भी वस्तु का अनमाना मूल्य ले सकता है। बाजार से सामग्री क्रय करने के लिए पहले हमें बाजार का पूर्ण रूप से भ्रमण करना चाहिए। तथा सम्बन्धित दुकानदारों से भाव एकत्रित करने चाहिए।

निविदा सूचना (Tender Notice):-

राजस्थान राज्य विद्युत परिषद्

मुख्य अभियन्ता, राजस्थान राज्य विद्युत परिषद् राजस्थान निम्न सामग्री के लिए मुहर बन्द निविदा आमन्त्रित करते है।

निविदा नं. --- शक्ति ट्रांसफॉर्मर 100 KVA, 3-ф 50Hz, 11/0.433 KV --- 50 संख्या (quantity)।

अनुमानित मूल्य (estimated cost) Rs 10,00,000.00

निविदा फॉर्म का मूल्य ₹ 50.00

निविदा फॉर्म की अन्तिम तिथि- due date ---

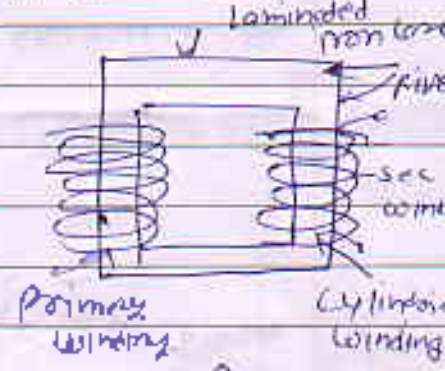
EE- 304 Electrical Design and Drawing.

1st test 2017

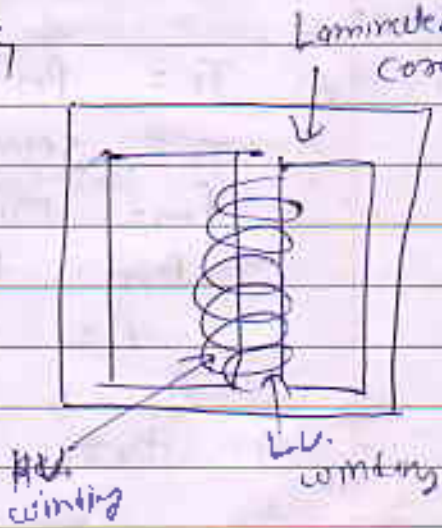
Q.1 Compare the core and shell type transformer. ?

Ans Core type transformer :- इसमें वायडिंग के लिए कुण्डली बेलनाकार आकृति की होती है। ये चौकोर या अण्डाकार भी हो सकती है। इन्हे एक कुर्में पर लपेट कर बनाया जाता है। यदि छोटे ट्रांसफॉर्मर बनाते हो तो आयताकार कोर क्रोसफुल की कोर प्रयोग में लेते है। उच्च वोल्टेज ट्रांसफॉर्मरो में कोर को लगभग गोलाई में लगाया जाता है।

कोर की दोनो भुजाओं पर वायडिंग स्थापित होती है। मैग्नेटिक सर्किट का एक ही मार्ग होता है। कोर की भुजाओं का क्रोसफुल समान होता है। कोर की दो भुजाए होती है। इनमे तांबे का प्रयोग अधिक होता है। इनमे हानियां अधिक होती है। इनकी देखभाल और मरम्मत करना सरल है।



Shell type transformer: इसमे E व I प्रकार की लेमीनेटेड कोर प्रयोग में ली जाती है। इसमे मध्य भुजा में वाइंडिंग की जाती है। इसमें चुम्बकीय फ्लक्स पतिपथ दो भागो में बंटा होता है। मैग्नेटिक सर्किट के दो मार्ग होते है। कोर की तीन भुजाए होती है। इनमें लीकेज फ्लक्स कम होता है। आउटपुट अधिक मिलता है। इनमें हानियां कम होती है। ये अधिक क्षमता के होते है। इनकी देखभाल और मरम्मत में कठिनाई होती है।



Q② ट्रान्सफार्मर की EMF समीकरण लिखिए ?

E.M.F. Equation :-

$$e_1 = -T_1 \frac{d\phi}{dt} \quad \text{---①}$$

$$\phi = \phi_m \cos\omega t \quad \text{---②}$$

$$e_1 = -T_1 \frac{d}{dt}(\phi_m \cos\omega t)$$

$$e_1 = T_1 \omega \phi_m \sin\omega t$$

$$E_{1max} = T_1 \omega \phi_m$$

उक्त emf का r.m.s मान $E_1 = \frac{T_1 (2\pi f)\phi_m}{\sqrt{2}}$

$$E_1 = 4.44 f T_1 \phi_m \text{ volts}$$

$$E_1 = 4.44 f T_1 B_m A_i \text{ volts} \quad (\phi = B \cdot A)$$

समान रूप से द्वितीयक वाइन्डिंग में प्रेरित emf

$$E_2 = 4.44 f T_2 B_m A_i$$

T_1 = Primary winding turns
T_2 = secondary winding turns.
f_m = main flux max. value (Wb)
B_m = flux density (Tesla)
f = Supply frequency (Hz)
A_i = Area of core (m^2)

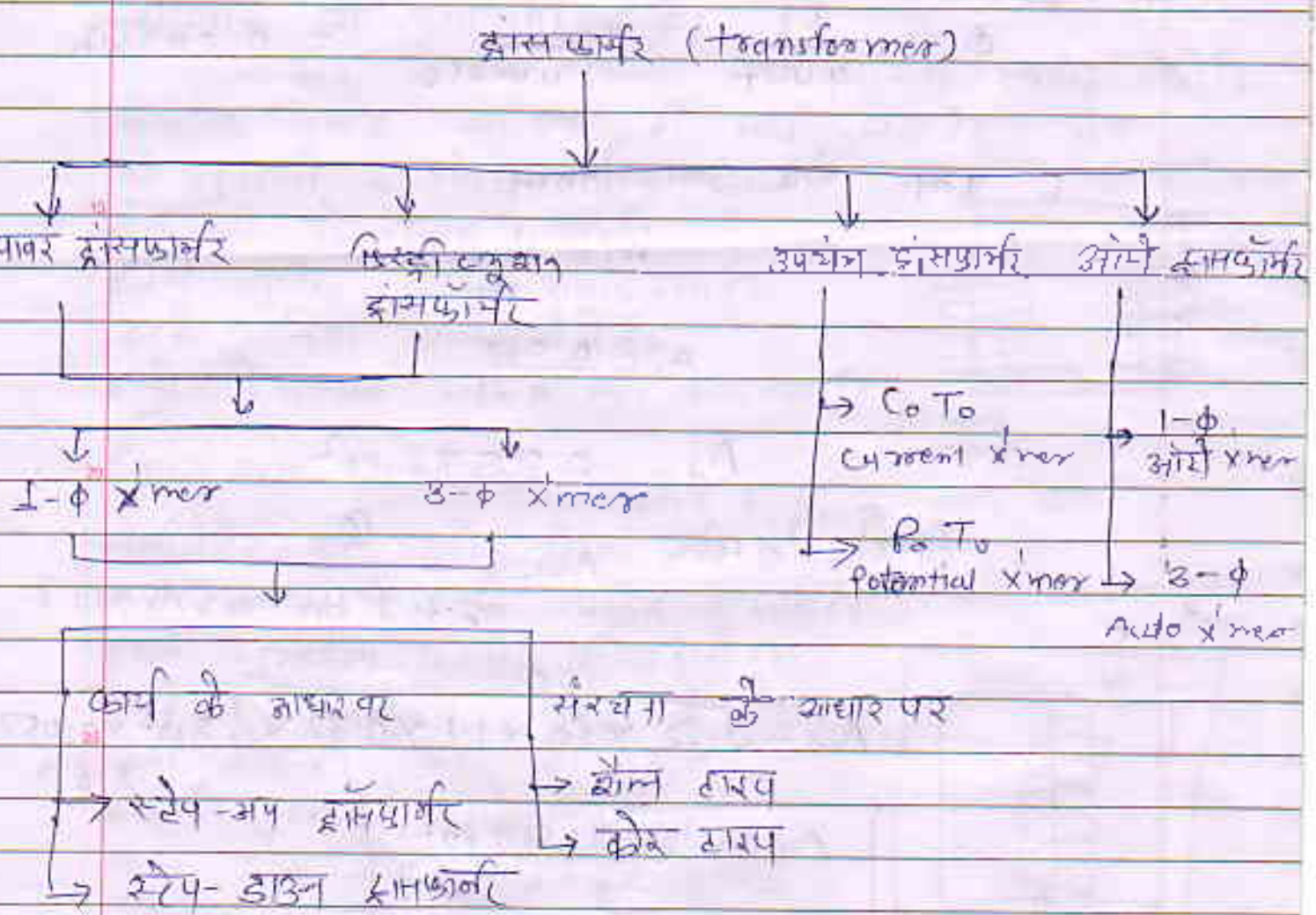
Per turn emf equation

$$\boxed{E_1 = 4.44 f \phi_m}$$

Q3. ट्रांसफॉर्मर की परिभाषा व वर्गीकरण बताइये ?

ट्रांसफॉर्मर – यह एक स्थैतिक चुम्बकीय युक्ति है। जिसमें दो या दो से अधिक वाइंडिंग होती है। ये वाइंडिंग एक संयुक्त चुम्बकीय क्षेत्र रखती है इनमे से एक प्राथमिक व एक द्वितीयक वाइंडिंग होती है जो क्रमशः स्रोत व भार से जुड़ी होती है

ट्रांसफॉर्मर का वर्गीकरण



→ एक 100 KVA, 50 Hz, 1-ϕ core type xmer का कोर एवं खिड़की का क्षेत्रफल ज्ञात करो। इसमें वर्गाकार कोर का उपयोग किया गया है। प्रत्येक प्रति वर्ग = 14 V, कोर का अधिकतम फ्लक्स घनत्व = 1.1 wb/m², खिड़की गुणांक = 0.32 एवं धारा घनत्व = 3 Amp/mm² ज्ञात कीजिए।

Solution दिया गया है $E_t = 14\ V$, $\delta = 3\ Amp/mm^2$
$B_m = 1.1\ wb/m^2$, $K_w = 0.32$

We know that

$$\phi = \frac{E_t}{4.44f} = \frac{14}{4.44 \times 50} = 0.063\ wb$$

कुल कोर का क्षेत्रफल

$$A_i = \frac{\phi_m}{B_i}$$

$$A_i = \frac{0.063}{1.1}$$

$$A_i = 0.0572\ m^2$$

खिड़की क्षेत्रफल $A_w = \dfrac{Q}{2.22 f B_m K_w \delta A_i \times 10^3}$

$$A_w = \frac{100}{2.22 \times 50 \times 1.1 \times 0.32 \times 3 \times 10^6 \times 0.0572 \times 10^{-3}}$$

$$\boxed{A_w = 0.0149\ m^2}$$