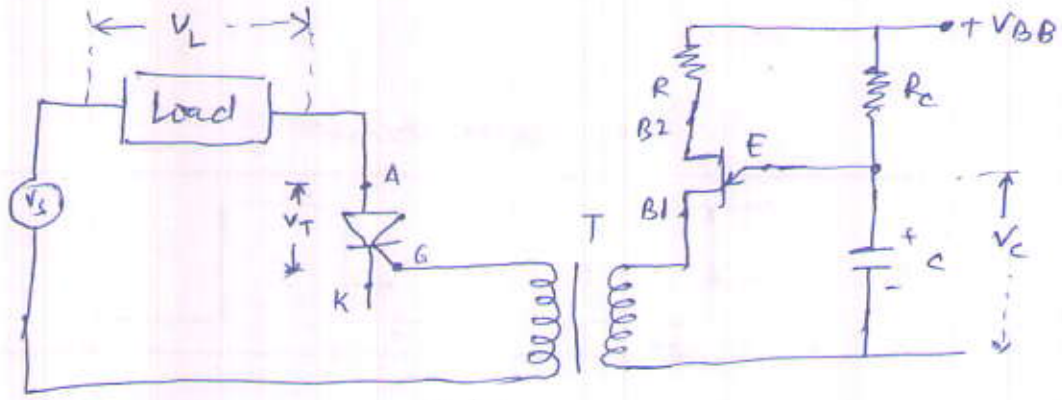
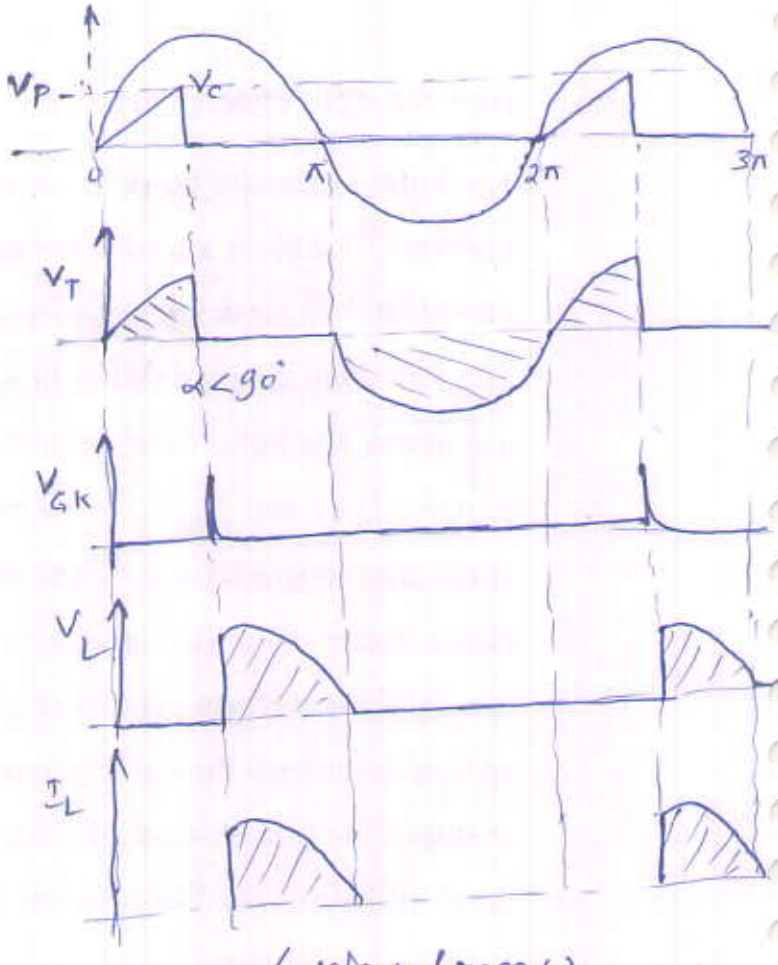
EL-305 Power and Industrial Electronics)

17/1/18 II nd Test

Que. 1 Explain Phase control of SCR using UJT ckt. (5)



(ckt)



(waveforms)

① The exact point of firing of SCR depends on appearance of gate pulse.

② Appearance of gate pulse depends the firing of UJT

③ The UJT is used here as a relaxation oscillator to obtain sharp repealative pulses.

④ The pube transformer is used to isolate the controll ckt from main circuit

⑤ The UJT breaks down when the voltage between

emitter and base B_1 reaches the peak voltage V_p given by equation

$$V_p = \eta V_{BB} + V_D$$

where η = intrinsic stand off ratio
V_D = diode cut in voltage
V_{BB} = Applied voltage to UJT, R_c and cap.

(6) Initially capacitor starts charging from 0 or to reach maximum voltage V_p. At V_p, UJT fires, and capacitor discharges through emitter and a pulse occurs to trigger the thyristor.

(7) The cap. voltage V_c depends on time constant R_c

$$\tau = R_c \cdot C$$

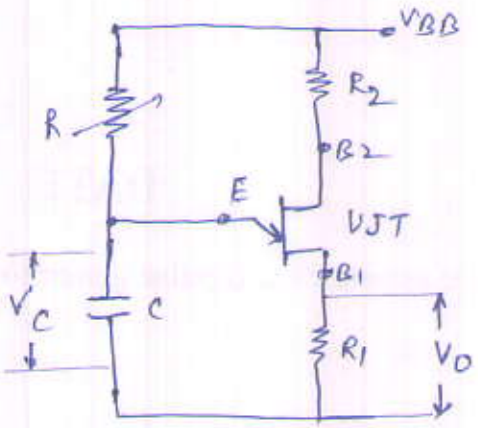
where τ = time constt of ckt

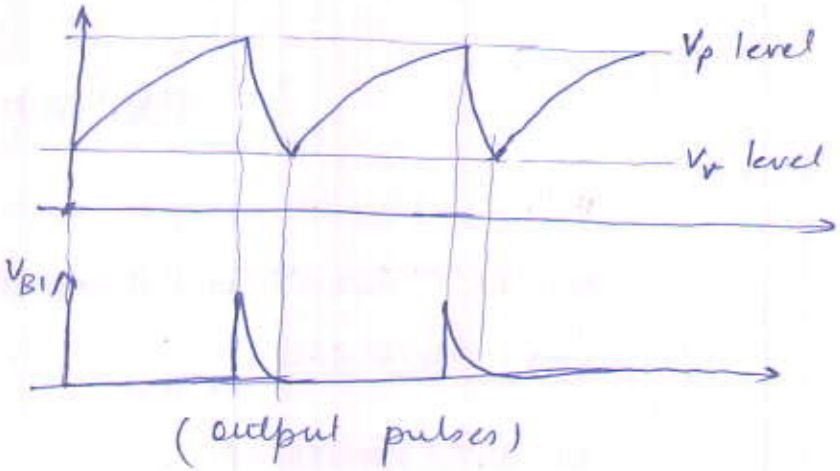
(8) As soon as the pulse in the primary of the pulse transformer appears, a pulse at the secondary of the transformer also appears and UJT fires.

(9) Before firing of SCR, the whole input voltage appears across thyristor as V_T. After firing of SCR, the whole input voltage appears across the load as V_L

(10) The V_L and I_L waveforms are same b'coz the load is resistive

Qu-2 Explain UJT as a relaxation Oscillator circuit.





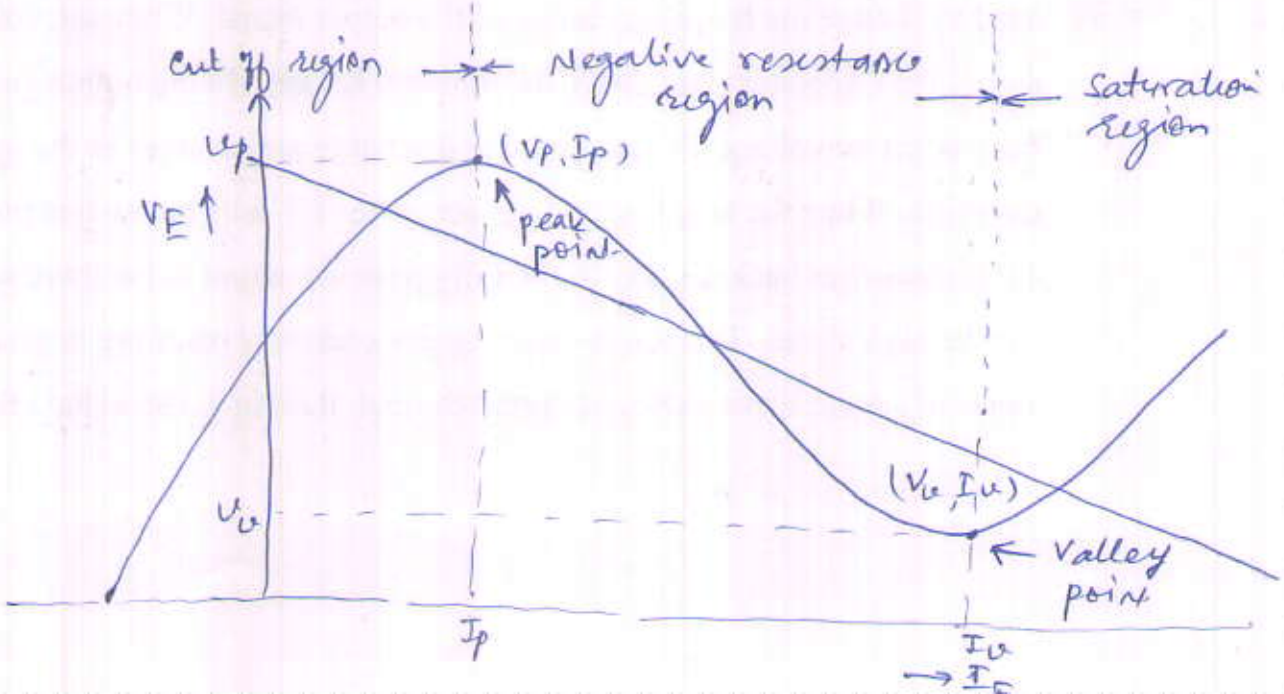
(output pulses)

① Since the UJT exibit the negative resistance characteristic it can be used as relaxation oscillator as shown above

② the external resistances R_1 and R_2 in comparison with the internal resistances R_{B1} and R_{B2} of UJT base

③ the charging resistance R shoud be such that its load line intersect the device characteristic only in negative resistance region

④ At the power supply is switched on, the cap. C starts charging to the supply voltage V_{BB} through resistance R



The capacitor charges with a time constt $R_e \cdot C \leq R_1 C$

(3) When $V_c < V_p$, the UJT is off

(4) As time passes, the V_c becomes equal to V_p and the UJT fires and the capacitor starts discharging through R_1 and a pulse obtained across R_1

(1) The voltage across cap during charging is

$$V_c = V_{BB}\left(1 - e^{-\frac{t}{Rc}}\right) \quad \text{——} (1)$$

The voltage level at which UJT fires is $V_c = V_p = \eta V_{BB}$ —(2)

From (1) and (2)

$$V_{BB}\left(1 - e^{-\frac{t}{Rc}}\right) = \eta V_{BB}$$

$$1 - e^{-\frac{t}{Rc}} = \eta$$

$$1 - \eta = e^{-t/Rc}$$

Taking log to both sides

$$\ln(1-\eta) = -\frac{t}{Rc}$$

$$\Rightarrow \frac{t}{Rc} = \ln\left(\frac{1}{1-\eta}\right)$$

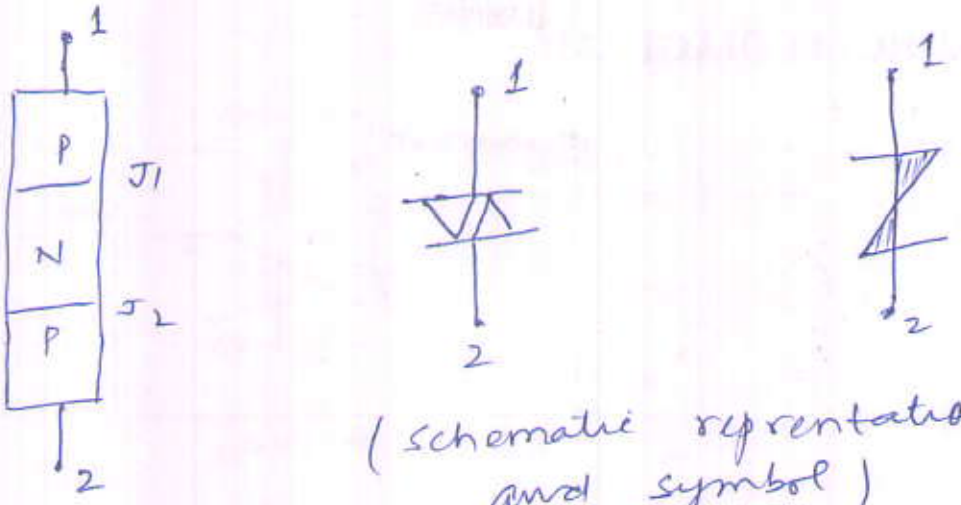
$$\Rightarrow \frac{1}{t} = \frac{1}{Rc \ln\left(\frac{1}{1-\eta}\right)}$$

$$f = \frac{1}{Rc \ln\left(\frac{1}{1-\eta}\right)}$$

$$f = \frac{1}{2303\, Rc \log\left(\frac{1}{1-\eta}\right)}$$

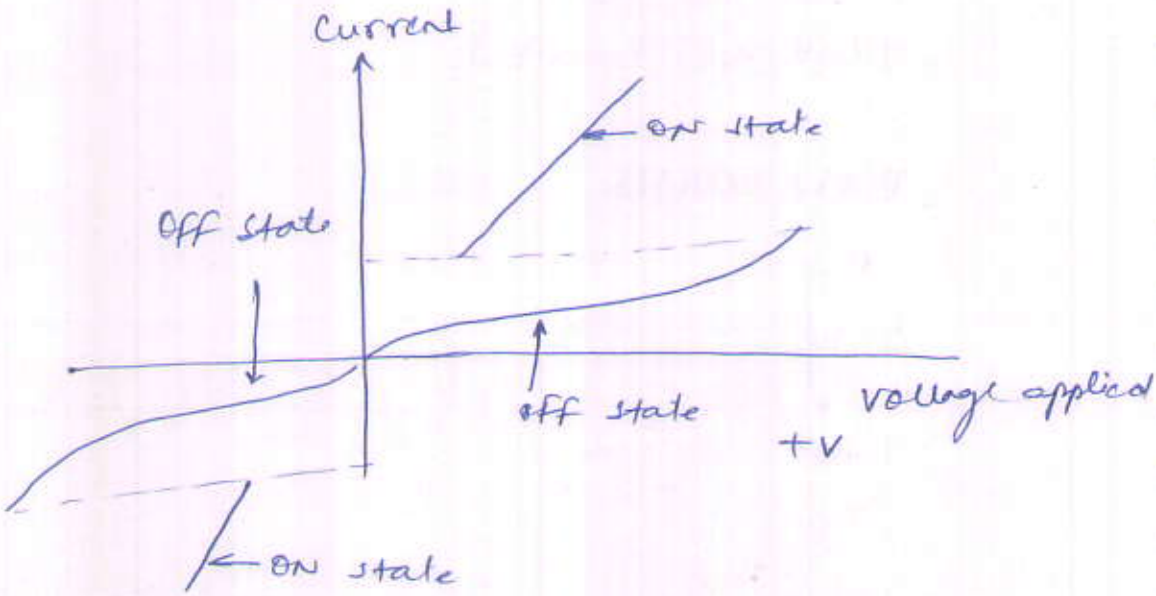
Where η = intrinsic stand off ratio

Qn 3 Write short Note on DIAC



(schematic representation and symbol)

① DIAC is a two electrode, three layer bidirectional avalanche diode which can be switched from OFF to ON state for either polarity of applied voltage.



② No gate terminal

③ Switching from off to on state is achieved by exceeding avalanche breakdown voltage in either direction

④ Two p-regions should have similar dopping characteristic resulting in symmetrical characteristic for both positive and negative voltages.

⑤ When voltage is applied, small saturation current appears across reverse biased P-N Jn.

⑥ When $V_{applied} > V_{avalanche}$,

the diac current increases sharply and DIAC becomes turn ON. In this turn on state, the voltage across the diac decreases sharply with increasing current

⑦ DIAC is a diode which works on AC

⑧ DIAC is mainly used for triggering of TRIAC

⑨ DIAC breakdown voltage is 30 v. While conducting, it acts like a low resistance with 3V drop across it