# IQRA NATIONAL UNIVERSITY

## Department of Electrical Engineering

# Power Electronics

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**Semester:** 8th

# Power Electronics

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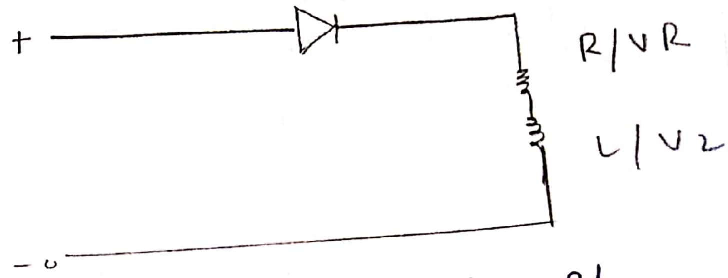
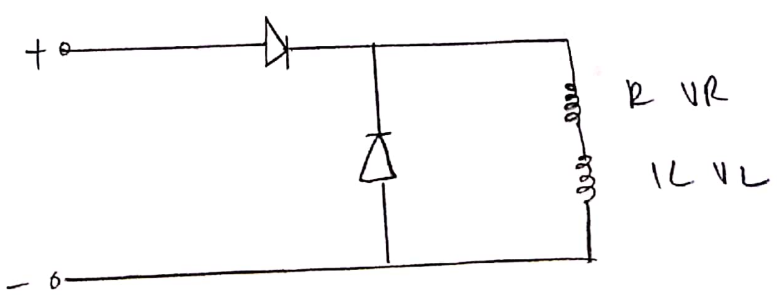
13170

## Question No (1):-

Fig ①



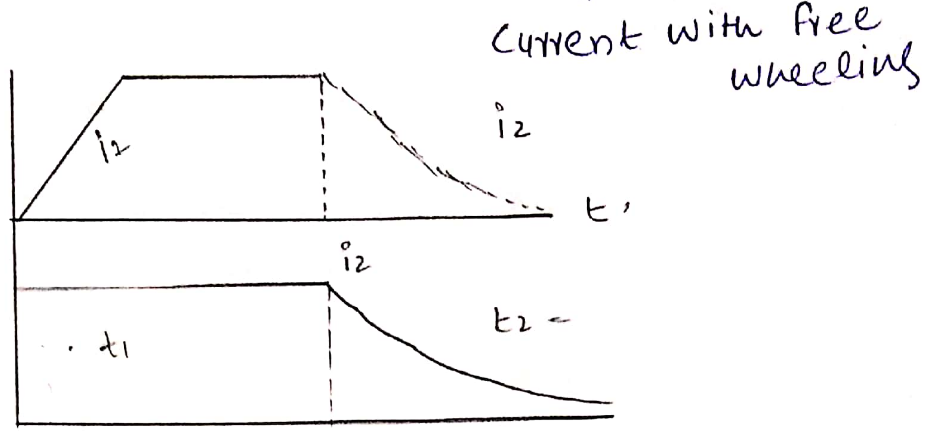

Answer: when diode is Connected in RL Circut during positive the inductor become energize the its function is that inductor will Store energy when the positive cycle is start the Inductor become deenergize and Creation of the decary current and high voltage take Place




When the Free wheeling diode is Connected in Parrallel will RL Circut during negative diode the

the inductor become denergize and free wheeling diode will provide path to decay Current to avoide from any damage

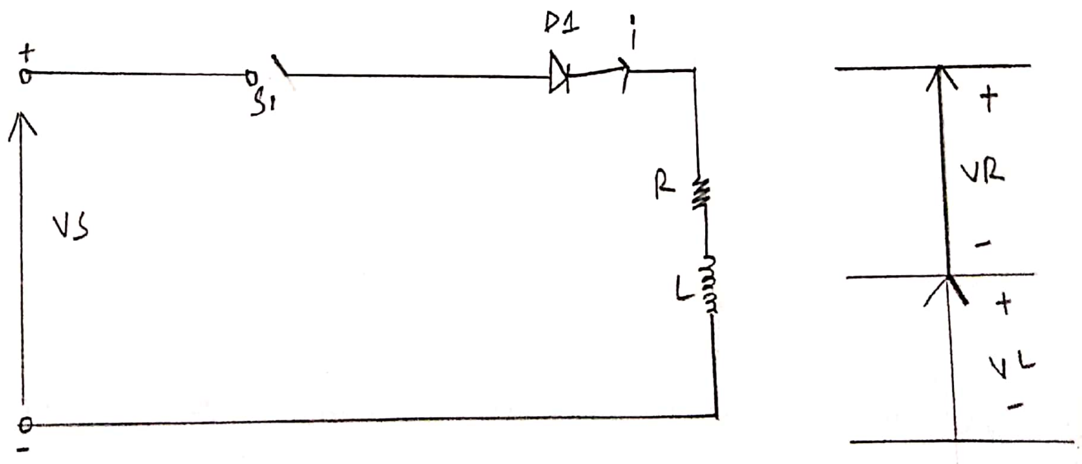
=> wave Form




=> where RL circut there is no need of the free wheeling diode and have no impact on the circut.

## Method # 02

=> RL connected in series with diode.




=> when S1 is closed at t=0, the current through the inductor increase

⇒ and is expressed as

$$V_S = V_L + V_R = L\frac{di}{dt} + Ri$$

⇒ with the initial condition $i(t=0)=0$

$i(t)$ is expressed as

$$i(t) = \frac{V_S}{V_R}\left(1 - e^{-tR/L}\right)$$

$$i(t) = \frac{V_S}{V_R}\left(1 - e^{-tR/L}\right)$$

⇒ The rate of chsnge of this circuit

can be obtained from.

$$\frac{di}{dt} = \frac{V_S}{L} e^{-tR/L}$$

⇒ The intial rate of rise of the

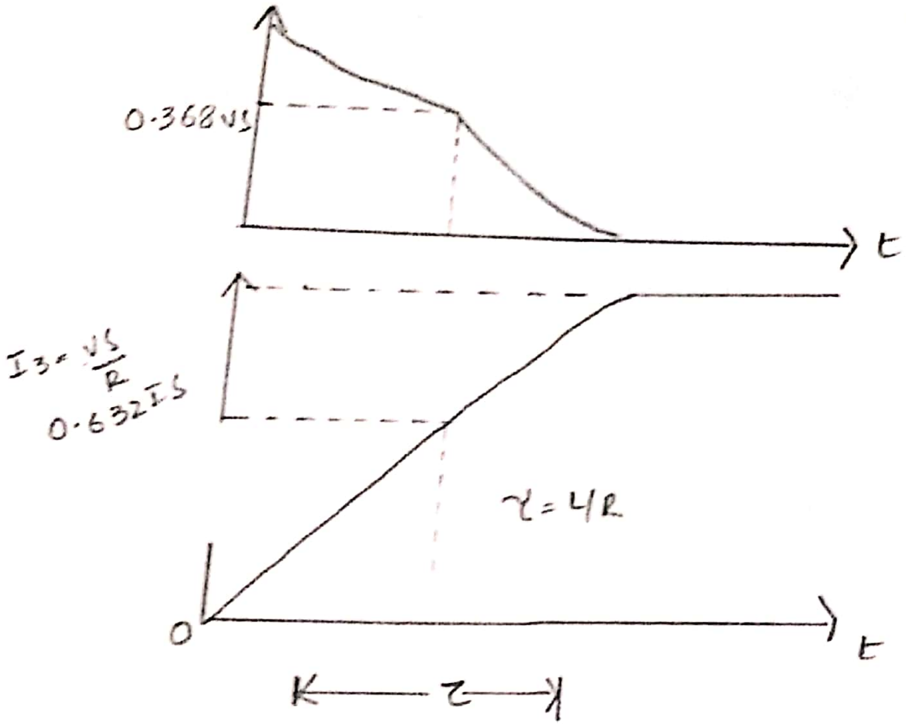
current (at $t=0$) is obtained

$$\left.\frac{di}{dt}\right|_{t=0} = \frac{V_S}{L}$$

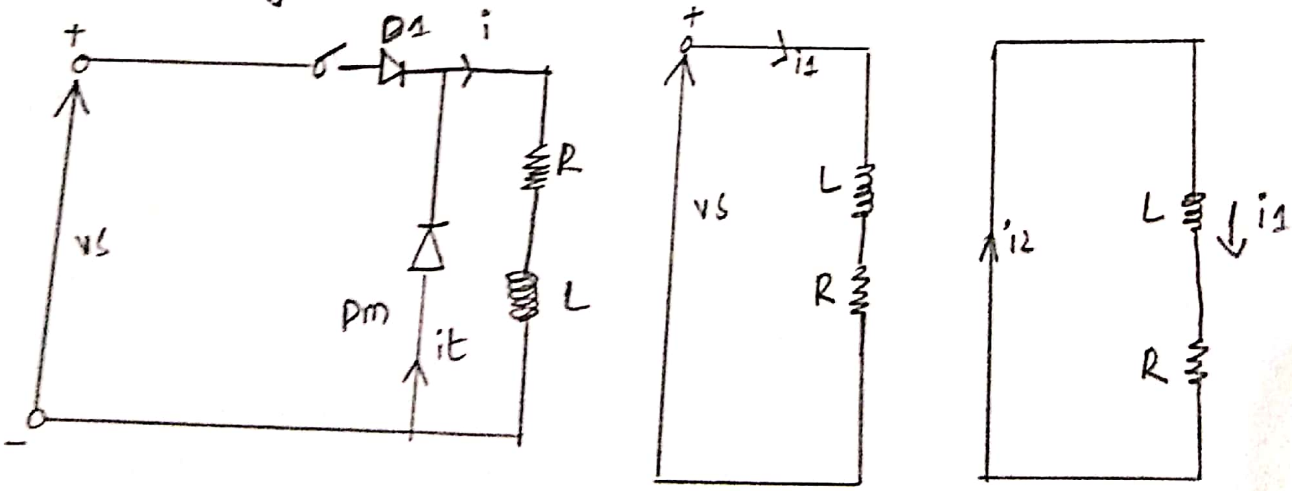
The voltages across the inductor

is $V_L(t) = L\frac{di}{dt} = V_S\, e^{-tR/L}$

=) where L/R $\tau$ is the time Constant of RL load the wave forms for the voltage and current are shown.




=) RL Circut Connected in parrallel with wheeling diode




(Circut diagram) Mode(1) Mode(2)

=) The inductor has property to Store energy

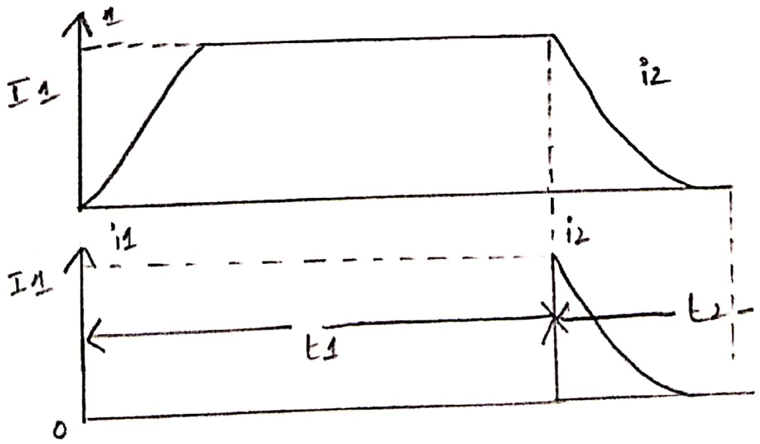
=) In AC current during positive high cycle the inductor Stores energy

=) At negative half cycle the inductor de-energies

=) This may cause reverse damage to Circut

=) To aviod energy discription free wheeling diode is used

=) In negative half cycle the free wheeling diode is becomes forword bias so the current will flow through diode.




=) waveform

# Question No #01 (part B)

=> Data

Answer :-

$VT = 1V$

$VDS = 70V$

$VGS = ?$

For saturation mood

$VDS = VGS - VT$

$VGS = VDS + VT$

$VGS = 70 + 1$

$\boxed{VGS = 71V}$ Ans.

(ID # 13170)

# Question No # 02

=> Part (A)

Answer :- ① The Switch Rate of the appliance will be low because BJT have lower swiching rate than MOSFET (Perfomance Base)

② Losses will be Low because losses in BJT is less then MOSFET and is an important advantage of BJT in appliance.

③ ON high frequency BJT are less effecient and it also effect the performence

④ Swiching losses will increase because of the BJT in appliance.

⑤ BJT operate on high frequency also have an impact on performance

⑥ ON state voltage low for BJT so the efficency of the appliance decrease

⑦ Conduction Losses decrease in BJT Performance improve.

=> (B) Question (2)

(i) SCR have no capabilities to handle high frequency that is the one of the impact on its perfomence.

(iii) SCR can handle more power, voltage current which increase the efficency of the appliance

(iv) SCR can be protected and became one of the Fuse which can decrease losses used as Switch the performance will be improve.

(V) The Cost of the Scr is less then mosfet is the one of advantage

(VI) And another problem is that Simultaneously one the Scr is the one of the disadvantage

(VII) And it is very easy to operate.

## Question # 03

(a) Given Data

VCC = 170 V

RC = 70V

V B = 10V

V CE = 1 V

VBE = 1.5V

=> To Find

(a) Mode = ?

(b) RB = ?

(c) B Force = ?

(d) PT = ?

=) (Solution)

(a) Transistor as Switch

(b) $R_B$ = ?

=) we know that

$$I_{CS} = \frac{V_{CC} - V_{CE(sat)}}{R_C}$$

$$\frac{170-1}{70}$$

$I_{CS}$ =) 2.4 A

we know that

$$I_{BS} = \frac{I_{CS}}{\beta_{E(min)}}$$

$$=) \frac{2.4}{8}$$

= 0.3 A

we unow that

$I_B$ = ODF * $I_{BS}$

=) 5 * 0.3

$\Rightarrow$ 0.5 A

we know that

$R_B = \frac{V_B - V_B}{I_B}$ VBC

$\Rightarrow \frac{10 - 1.5}{1.5A}$

$\Rightarrow 5.6 \Omega$

**(c)** B Force $= \frac{I_{CS}}{I_B}$

$\Rightarrow \frac{2.4}{1.5}$

$\Rightarrow 1.6$ A

**(d)** $P_T = ?$

we know that

$P_T = V_{BE} I_B + V_{CE} I_C$

$\Rightarrow (1.5)(1.5) + (1)(2.4)$

$\Rightarrow 2.25 + 2.4$

$\Rightarrow 4.65$ watt. Answer.