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Assignment # 3

Subject: power electronics

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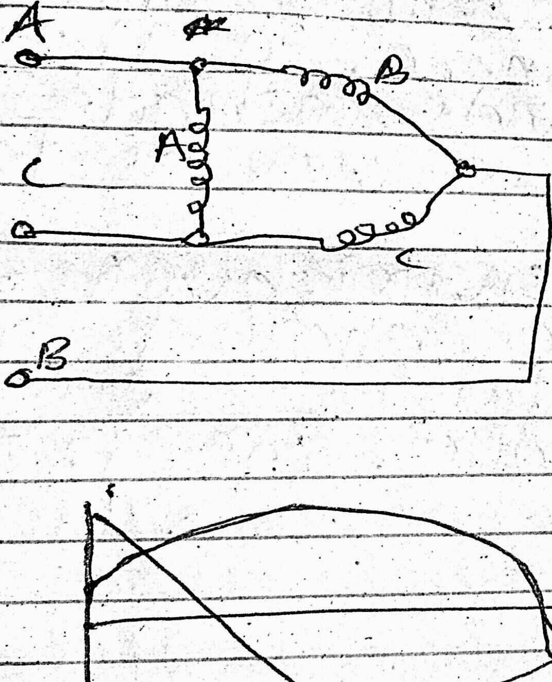
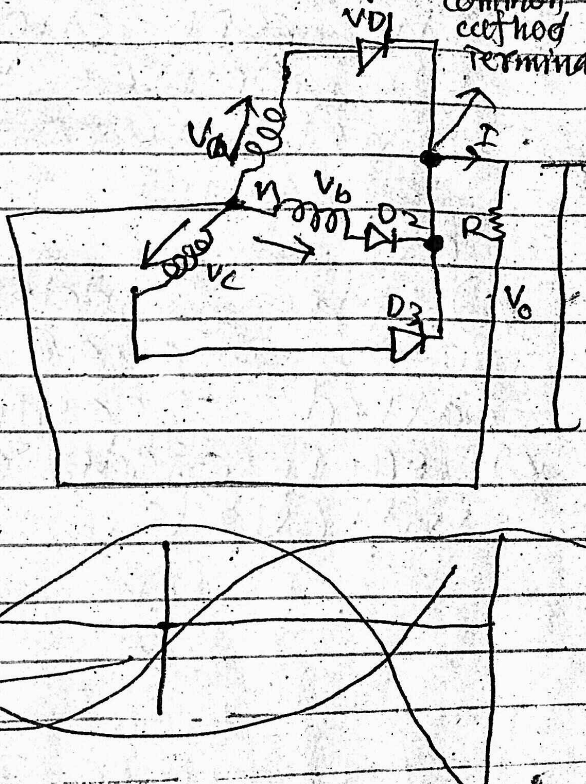
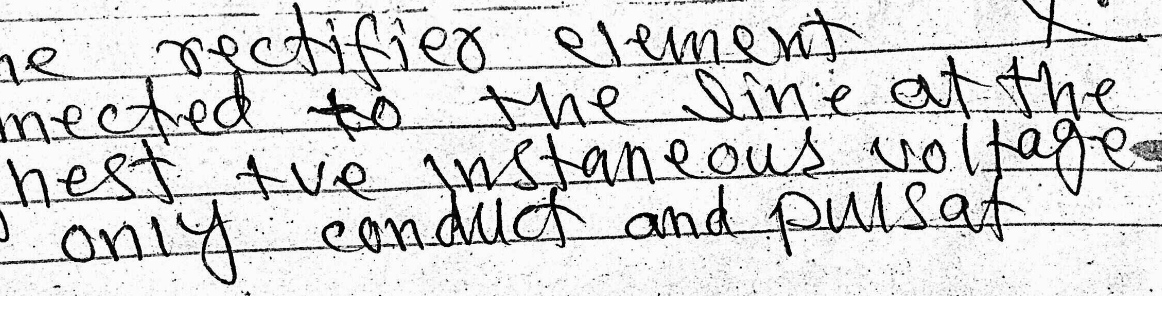
Q1 3-ϕ Half wave uncontrolled Rectifier:

it uses a 3-ϕ transformer with primary in Delta and secondary in star connection. D_1, D_2 and D_3 have common connected cathod to common load R and all diodes are oriented in difference phases and therefore called as common-cathod circuit.







*) the rectifier element connected to the line at the highest +ve instaneous voltage can only conduct and pulsat

b/w v max and 0.5 v max.

*) it is called 3-ϕ3 pulse rectifier as the o/p is repeated thrice in every cycle of vs.

*) the ripple frequency(f_r) of o/p voltage is

$f_r = n f_s$, n = No of diodes
f_s = AC supply freq.

the ON diode connects its most +ve source terminal to the other two diode cathodes keeping the other diodes off.

*) the sudden switchover from one diode to another is called "commutation".

*) each diode conducts for 120 intervals.

=) Full wave uncontrolled bridge rectifier:

*) On the positive Half cycle of the transformer secondary supply voltage, diodes D_1 and D_2 conducts supplying the voltage to the load.

*) On the -ve half cycle of supply voltage, diodes D_3 and D_4 conducts supplying this voltage to the load.

*) it can be seen from the waveform that the peak inverse voltage of the diodes is only Vm.

Peak reactifier diode current

$$= \frac{Vm}{R}$$

Q1) part (B)

*=) Phase control rectifiers:

*) unlike diode, an SCR does not become conducting immedietly after his voltage becomes +ve.

*) it requires triggering by means of pulse at the gate.

*) So it is posible to make the thyristor conducts at any points

point on the half wave which applies the voltage at its anode.
*) Thus output voltage is controlled.

=) Phase control rectifier - Application.
*) Still rolling mills, paper mills, textil mills where controlling of Dc motor speed is necessory.
*) electric traction *) High voltage DC Transmission.
*) electromagnet power supply.

=) φ uncontrolled Rectifier:
*) φ Rectifier offers the following advantages.
(1) Higher o/p voltage for a given i/p voltage.
(2) Lower amplitude ripple i.e output voltage is smoother.
(3) Higher frequency ripple simplifing filtering
(4) Higher overall ~~for~~ efficiency.

=) uncontrolled Rectifier: (classification)
they are generally of four types.
(1) 3-φ Half wave rectifier.
(2) 3-φ mid-point 6 pulse rectifier.
(3) 3-φ Bridge rectifier.
(4) -φ 12 pulse rectifier.

Q No2:- Given Data:-

$V_m = 73V$
$R = 68\Omega$

Solution:-

(1) Vdc

$= V_{dc} = \frac{V_m}{\pi} = \frac{73}{3.1428}$

$V_{dc} = 23.24\ V$

(2) $I_{dc} = \frac{V_m}{\pi R} = \frac{73}{3.14 \times 68}$

$I_{dc} = 0.341\ A$

(3) $V_{rms} = \frac{V_m}{2} = \frac{73}{2}$

$V_{rms} = 36.5\ V$

(4) $I_{rms} = \frac{V_m}{2R} = \frac{73}{2 \times 68}$

$I_{rms} = 0.5367 A$

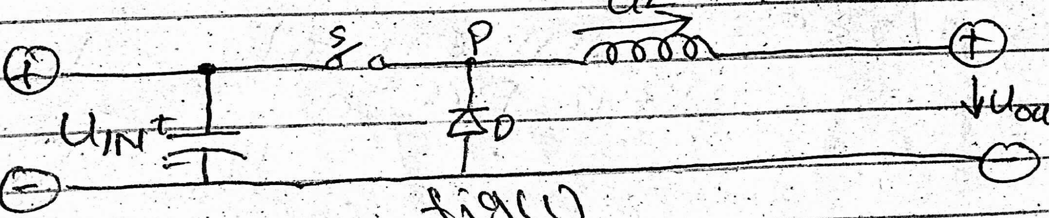
(5) whereas in center tapped rectifiers, the inverse voltage coming across each diod is double the maximum voltage across the half of the secondary winding. the transformer utilization factor (TUF) also more in bridge rectifier as compared to the center tapped & full wave rectifier, which makes it more advantages.

Q No 3:- Principle and working of Buck converter

=) working of Buck converter:-

it works by switching ON and off. so it can get a much higher power efficiency than a linear power supply. which it step down voltage from a high input to a low voltage output. while it will step up output current to load. so it lets save power source.

=) Principle of Buck converter



fig(1)

The DC to DC converter will circuit will change the voltage source. To higher or lower or something else. By purpose of the designer or our circuit ideas. when we see a basic buck converter circuit as fig(1). it is easy to understand with.

*) U_{in} is an input voltage as popular of a European country and "V_{in}" of the united states.

*) U_{out} is an output voltage European countries. and "V_{out}" on the united states.

In this circuit, it consist of 3 main components only.

*) S is a switch, in the real circuit, we use a transistor.
*) D is a Diode.
*) L is a coil or indictor.
*) C is a capacitor.

*

QNO 3:- Numerical solution:-

Given Data:

$V_{IN} = 50V$

$D = 73\%$

Load of $R = 68\Omega$

Switching $f = 20\ Hz$

find

(1) V_{out} (2) I_{out}

(3) I_{in} (4) inductor (L)

Solution:-

(1) We know that

$V_{out} = D V_s$

$V_{out} = 73\% \times 50 = 0.73 \times 50$

$V_{out} = 36.5\ V$

(2) $I_{out} = \frac{V_o}{R} = \frac{36.5V}{68}$

$I_{out} = 0.5367\ A$

~~(3) $I_{IN} = \frac{V_{in}}{R} = \frac{50V}{68}$~~

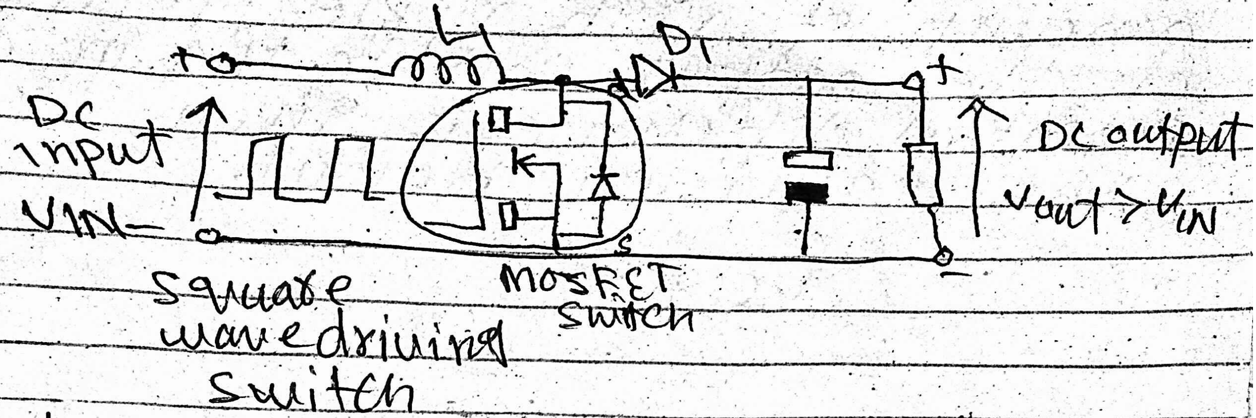
~~$I_{IN} = 0.7352\ A$~~

(3) $I_{IN} = D I_o = 73\% \times 0.5367\ A$

$I_{IN} = 0.3917\ A$

~~QU8- Buck conv~~

QU8- Boost converter working and principle



in This converter the first transistor is switched ON contineously and for the second transistor the squar wave of high frequency is applied to the gate terminal. the second transistor is in conducting when the ON state and the input current flow from the inductor L through the second transistor. the negative terminal charging up the magnetic field around the inductor. the D2 diod connot conduct because the anode is on the potential ground by highly conducting the second transistor. By charging the capacitor C the load is applied to the entire circuit in ON state and it can contstruct carries oscilator cycles. during the ON period the capacitor C can discharge regularly and the amount of high ripple frequency on the output voltage. the approximate potential difference is given by the equation below.

VS + VL

Q4) Numerical part

Given Data:-

$V_{IN} = 50\,V$

$D = 73\,\%$

$R = 68\,\Omega$

switching frequency
$f = 20\,Hz$.

find
(1) Vout (2) Iout (3) I_{IN}

(4) Inductor (L)

Solutions-

(1) we know that

$$V_{out} = \frac{V_s}{1-D} = \frac{50}{1-0.73}$$

$$V_o = 185.18\,V$$

(2) $$I_{out} = \frac{V_{out}}{R} = \frac{185.18\,V}{68}$$

$$I_{out} = 2.7233\,A$$

(3) $$I_{IN} = \frac{I_{out}}{1-D} = \frac{2.7233}{}$$

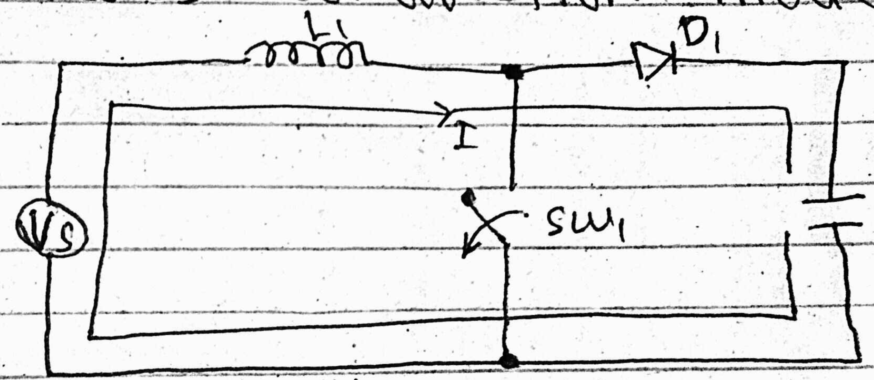
$$I_{IN} = 10.086\,A$$

(4) $$L = \frac{V_{in}(V_o - V_{in})}{f(\Delta I) \times V_o}$$

QNO4:- Principle and working of
Part(A) Boost converter.
continuous

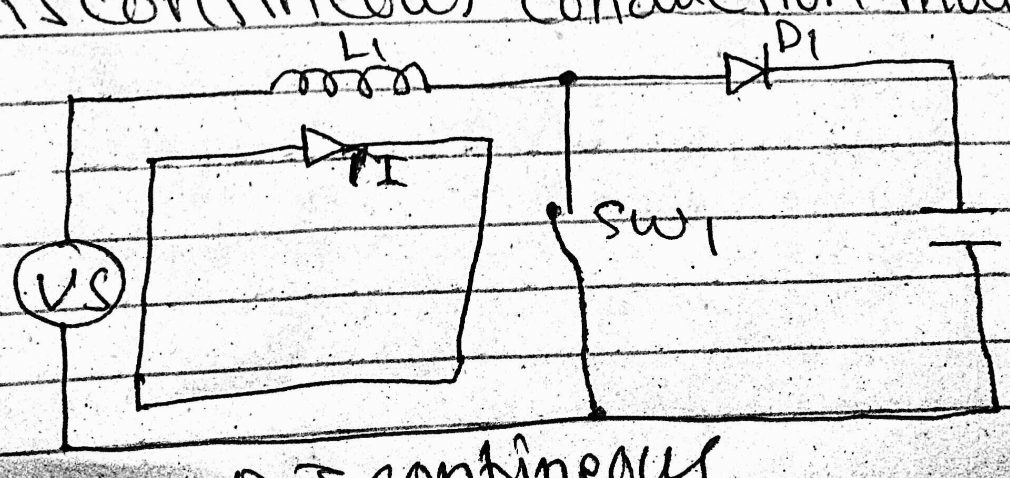
*) Working and principle of Boost converter :-
most of the electrical power circuit designer will choose the Boost mode converter because the output voltage is always high when compared to source voltage. in this circuit power stage can be operates in two modes:

1) contineous conduction mode (ccm)



Boost converter contineous conduction mode.

2) Discontineous conduction mode (DCM)

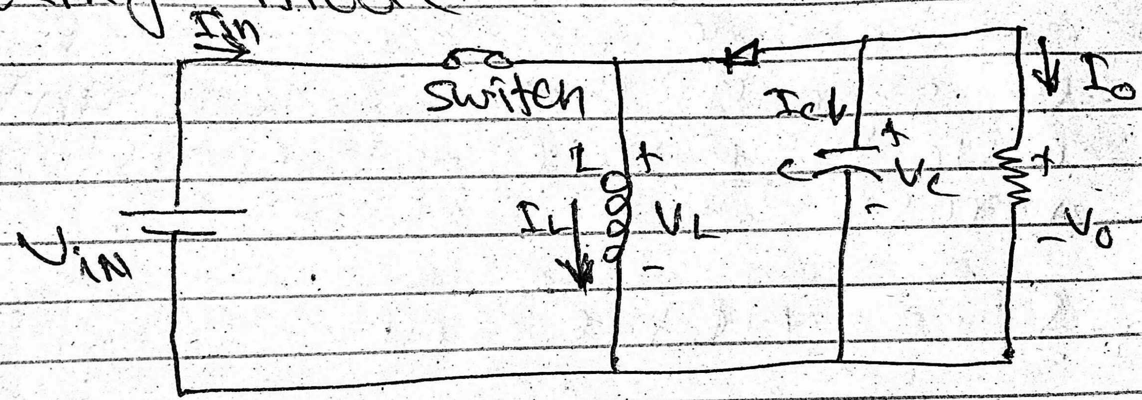


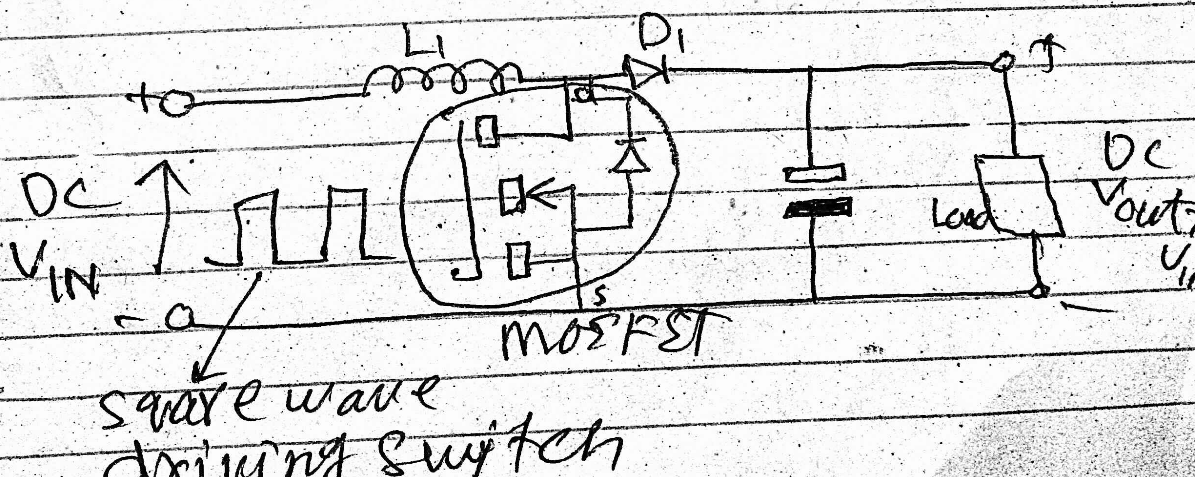
Discontineous

Q NO 5:- Principle and working of Buck boost converter.

=> Working of Buck Boost converter.

A buck Boost converter transform a positive DC voltage at the input to a negative DC voltage at the output. The circuit operation depends on the conduction state of the MOSFET: ON state: the current through the inductor increases and the diode is in blocking mode.





The main working principle of buck booster converter is that the inductor in the input circuit resists sudden variation in input current. When a switch is ON the inductor stores energy from the input in the form of magnetic energy and discharges it when switch is closed. The capacitor in the output circuit is assumed large enough that the time constant of RC circuit in the output stage is high. The large time constant compared to switching period ensures that in steady state a constant output voltage $V_o(t) = V_o$ (constant) exist across load terminal.

Q5:- Numerical Part:-

Given Data:

$V_{IN} = 50V$

$V_{out} = 73\%$

$R = 68\Omega$

$f = 20Hz$

solutions-

wee know that

find(i) Duty cycle

(i) $1-D = \frac{-V_{in}}{V_0 - V_{in}}$

$1-D(V_0 - V_{in}) = -V_{in}$

$V_0 - V_{in} = \frac{-V_{in}}{1-D}$

$V_0 = -V_{in} + V$

$V_0 = \frac{1}{1-D} = \frac{1}{1-}$

(i) $1-D = \frac{-V_{in}}{V_0 - V_{in}}$

$-D = \frac{-V_{in} - 1}{V_0 - V_{in}}$

$D = \frac{V_{in} + 1}{V_0 + V_{in}}$

$D = \frac{50V + 1}{0.73 + 50}$

$D = 1.0053$

(2) $I_{out} = \frac{V_0}{R} = \frac{0.73}{68}$

$I_{out} = 0.01073 \ A$

(3) $I_{in} = \frac{I_0 D}{1-D} = \frac{0.01073 \times 1.0053}{1 - 1.0053}$

$I_{in} = 2.035225 \ A$

(4) $L = \frac{V_{in} \times D}{f \times \Delta I}$

End