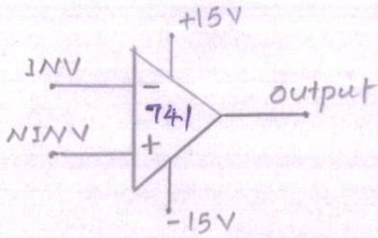
Revision : 2015 Course Code : 4042

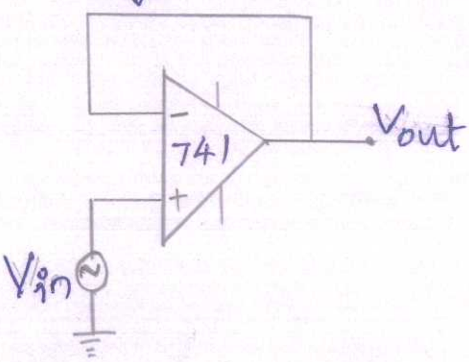
Course Title : LINEAR INTEGRATED CIRCUITS

Qst No.	Scoring Indicator.	Split up Score	Sub Total	Total
	PART - A			
I 1.	Maximum rate of change of output voltage with respect to time $S = \frac{dV_o}{dt}$	1 + 1	2	
2.	Symbol 	2	2	
3.	The rectifier circuit using op-amp is the precision rectifier. It is capable of rectifying signals of very small peaks (of the order of milli volt.). Also called small signal precision rectifier.	2	2	
4.	→ It is the range of frequencies over which the PLL can maintain lock with the incoming signal → Is usually expressed as percentage of the VCO frequency.	1 + 1	2	
5.	→ Is an electronic circuit to provide a predetermined d.c voltage → It generates a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions.	1 + 1	2	
				10

PART - B

II 1.
- → Infinite voltage gain → 1
- → Infinite input impedance
- → Zero output impedance } → 1
- → Zero offset voltage
- → Zero offset current. } → 1 6
- → Infinite bandwidth. → 1
- → Infinite CMRR. → 1
- → Infinite slew rate.
- → Zero input noise. } → 1

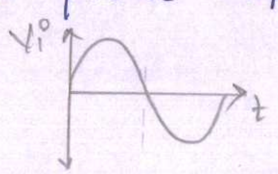
2. Circuit diagram 2

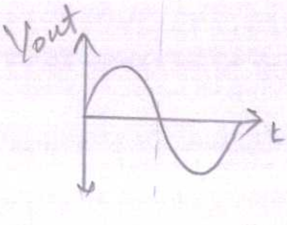


6

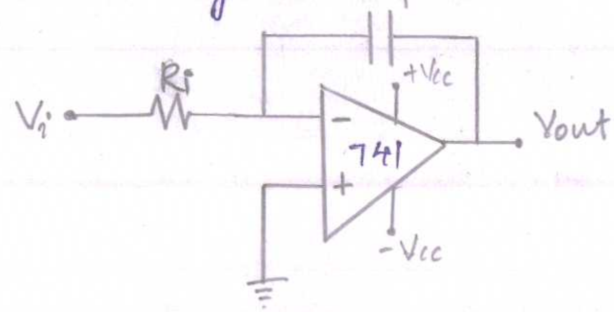
\+

- → output voltage Vout = Vin
- → Voltage gain is unity.
- → ie output follows the input and hence the circuit is called voltage follower circuit 4
- → No phase difference between input and output





3. Circuit diagram.



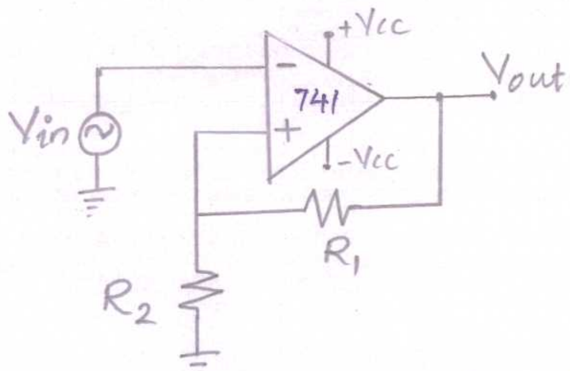
2

\+ 6

→ output voltage is proportional to the time integral of the input voltage. 4

→ $V_o = -\left[\frac{1}{C_f R_i}\right] \int V_i \, dt$.

4. Circuit diagram.



2

→ The comparator circuit with a positive feed back is the Schmitt trigger circuit. +

→ Also called as regenerative comparator

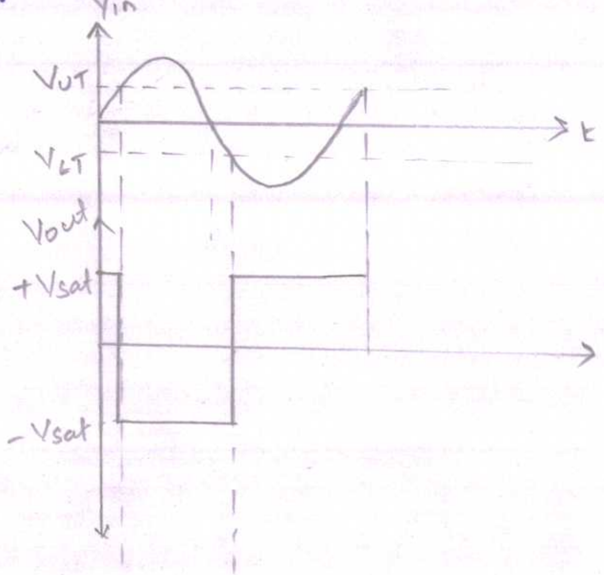
→ It is used to avoid the unwanted triggering due to the noise in the basic comparator circuit. 3

→ output voltage is always at $+V_{sat}$ or at $-V_{sat}$

→ output voltage level is controlled by the feed back factor $\beta = \frac{R_2}{(R_1+R_2)}$ +

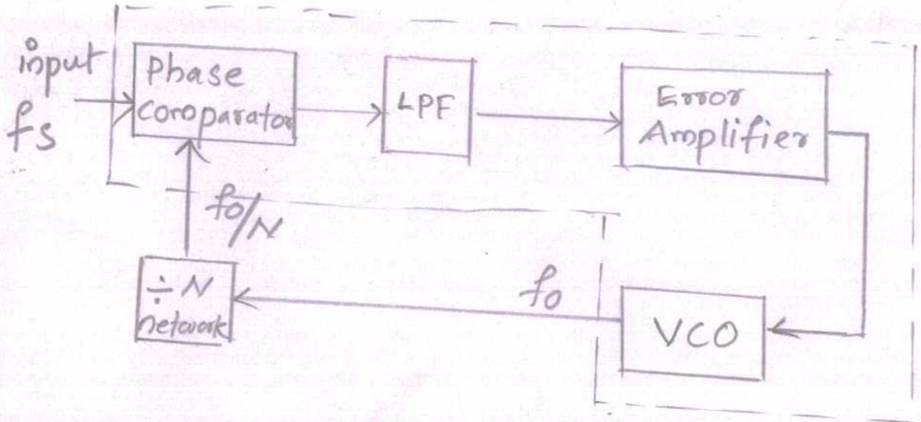
→ $+V_{ref} = +\beta V_{sat}$ → upper threshold Voltage

$-V_{ref} = -\beta V_{sat}$ → Lower threshold voltage wave form



1 6

5.

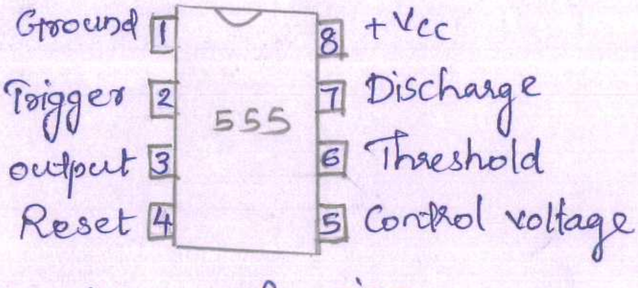


3 + 6

→ Since the output of the divider is locked to the input frequency f_s the VCO is actually running at a multiple of the input frequency 3

→ $f_o = N \cdot f_s$.

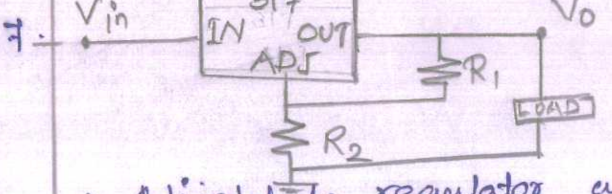
6.



→ 2 + 6

→ Functions of pins → 4.

7.



→ 3 + 6

→ Adjustable regulator with three terminals → 3

→ Require two external Resistors

30

III

PART- C

UNIT- I

(a) → CMRR :

Ratio of differential voltage gain to Common mode voltage gain 2

$$CMRR = 20 \log (A_d / A_{CM}) \text{ in dB}$$ +

→ Input offset voltage :

A small dc bias voltage applied between the input terminal to make the output zero Volt 2

+

→ input offset current :

Algebraic difference between the currents into the inverting and non-inverting terminals 2 8

$$I_{OS} = |I_{B_1} - I_{B_2}|$$

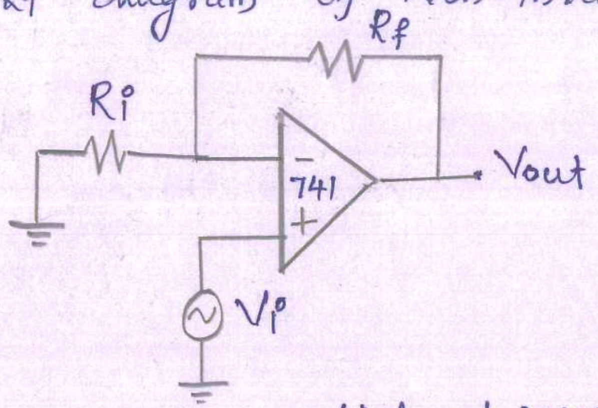
+

→ Input bias current :

average of the currents entering into the inverting and non-inverting terminals of an op-amp. 2

$$I_B = \frac{I_{B_1} + I_{B_2}}{2}$$

(b) ckt diagram of Non-inverting amplifier.



2

+

→ Input is applied at (+)ve terminal 2 7

→ outputs and inputs are in phase.

+

→ Voltage gain $A_v = \left[1 + \frac{R_f}{R_i}\right]$ → 3

* Derivation of equation

OR UNIT- I

IV (a) The popular packages are

1.) The metal can package (TO)

→ available in 3, 5, 8, 10 and 12 leads 2

→ chosen when heat dissipation is the main consideration. +

2.) The dual in line (DIP) packages. 2

→ for commercial applications.

→ easy to use 7

+

3.) The flat package.

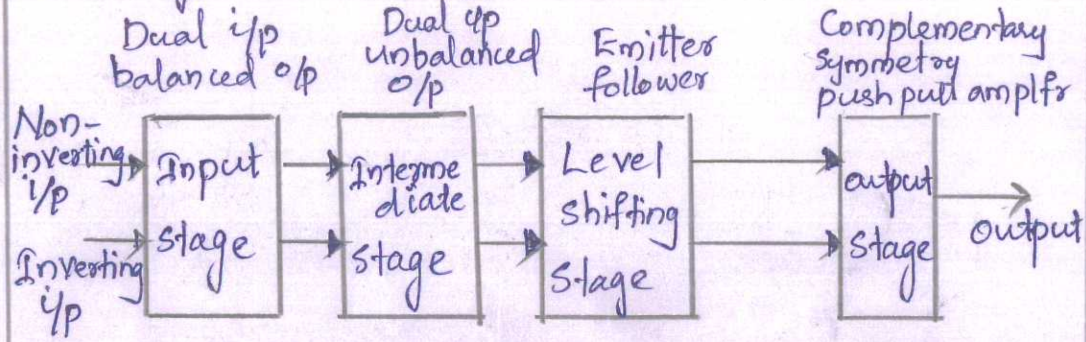
→ Is a compact package.

→ preferred for the circuit where space is critical. 2

+

→ diagram of each type 1

(b)



3

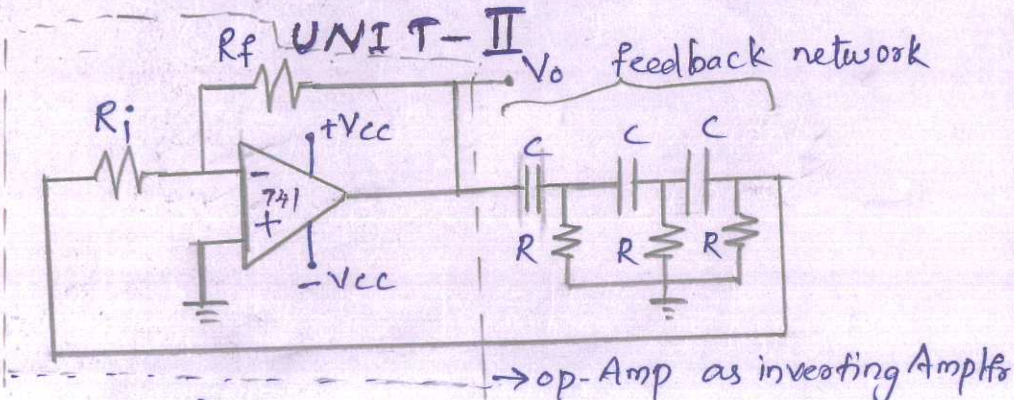
\+ 8

5

→ block diagram Explaination

UNIT – II

V (a)

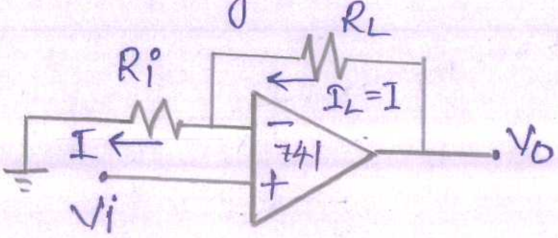


7

→ Audio frequency Sine wave oscillator

→ frequency of oscillation $f = \frac{1}{2\pi RC\sqrt{6}}$

(b) Circuit diagram:

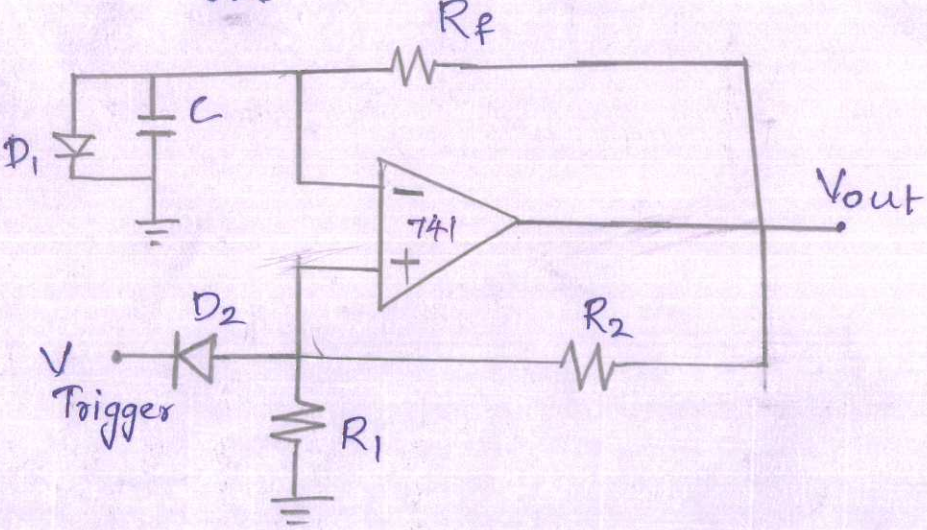


→ A circuit that convert a voltage to a proportional current even though the load resistance may vary. 8

→ For a single input the current in the load Resistor R_L is given by $I_L = I = V_i/R$

OR UNIT – II

VI (a)

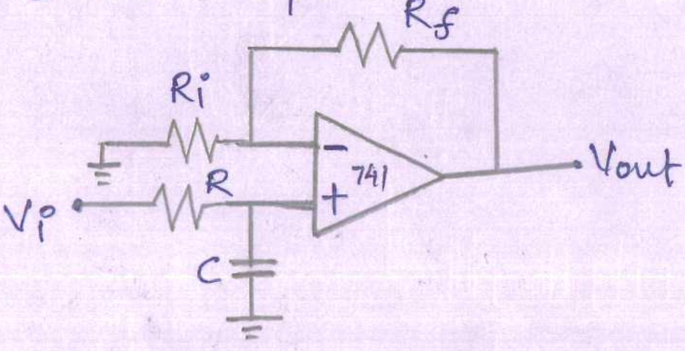


2½ + 8

→ wave form → 2 +

→ circuit explaination → 3½

(b)



→ 2 + 7

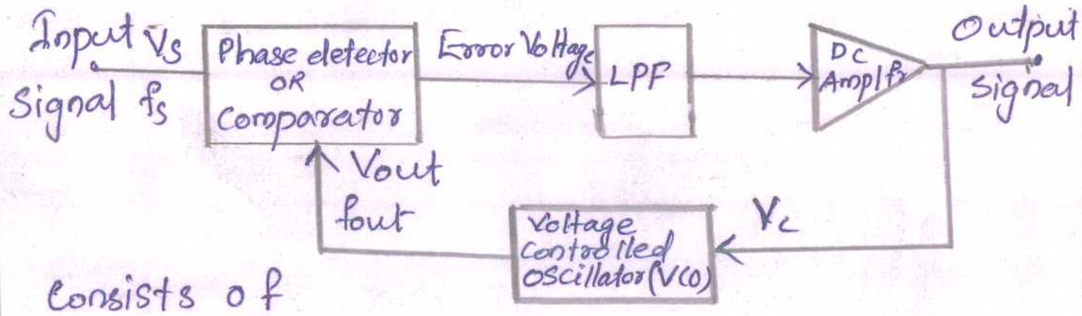
→ frequency response curve → 1½ +

→ circuit explaination → 3½

gain of this filter $A_F = [1 + R_f/R_i]$

UNIT – III

VII (a) PLL block diagram.



3

\+ 8

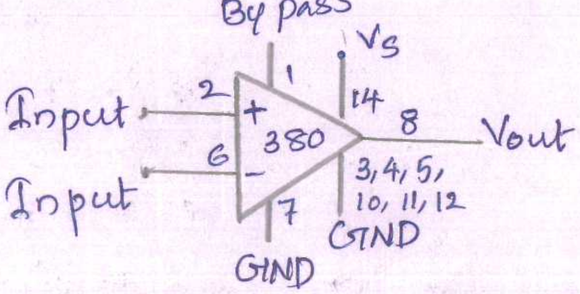
Consists of

→ 1. Phase detector
2. Low pass filter
3. D.C amplifier
4. Voltage Controlled oscillator VCO

} explaination 5

(b) 380 Audio power amplifier

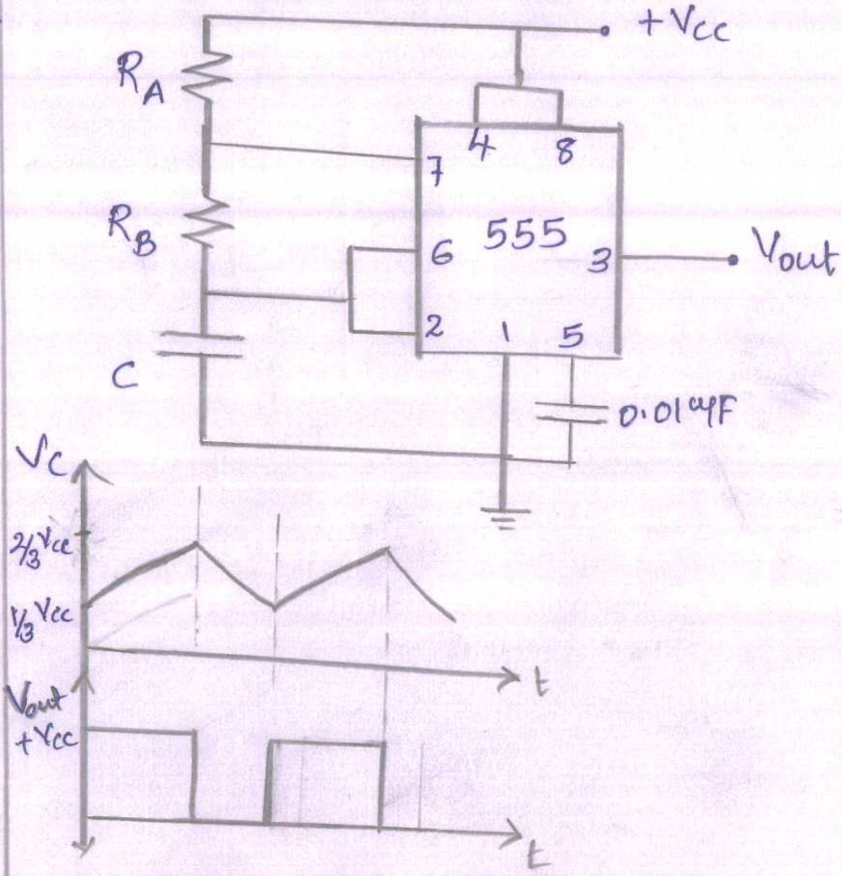
→ Much ideal for consumer applications.
→ Require minimum number of external components
→ Internally fixed gain
→ wide supply voltage range
→ output is automatically self centering to ½ of the supply voltage.
→ low quiescent power gain
→ high peak current capability.
→ low total harmonic distortion.
→ high input impedance. 7



→ Input stage is a PNP- emitter follower

VIII OR UNIT- III

(a)



3 + 1 + 8

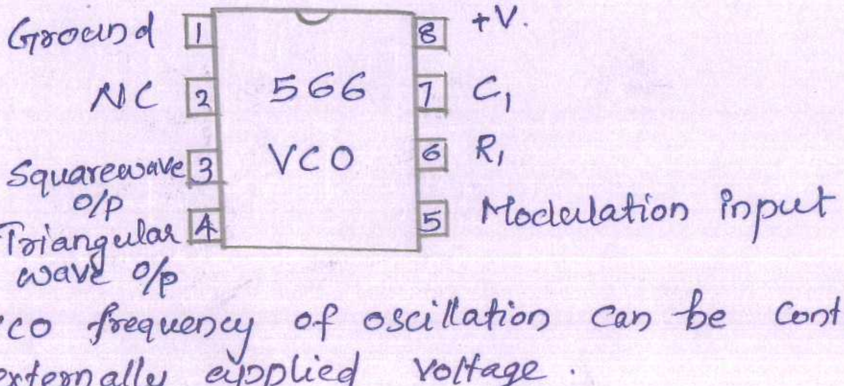
circuit explaination

→ Astable multivibrator generate squarewave

→ only two resistors and two capacitors are required to connect externally 4

→ when internal transistor is cut off the external capacitor 'C' charges through resistors and when the transistor ON, the capacitor discharges through R_B only. Thus the square wave is generated.

(b) Pin diagram



2 + 7

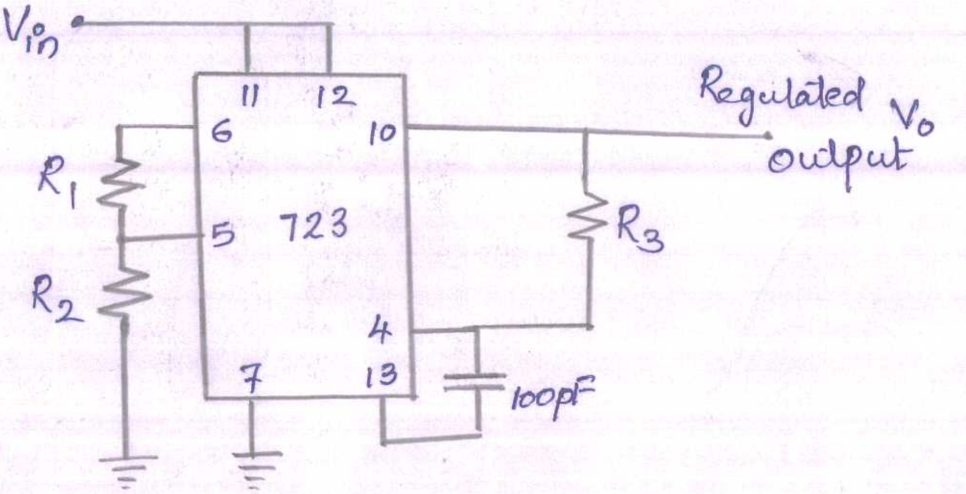
→ In VCO frequency of oscillation can be controlled by externally applied voltage. 5

→ VCO has 8 pins.

→ pin function explaination

UNIT- IV

IX (a)



3½

→ In the circuit of a lowvoltage regulator using 723 the output voltage will be regulated less than 7V

+ 8

→ pin 6 is the V_{ref} is connected to the pin 5 [$V_{non\text{-}inv}$] through R_1

→ output is fedback to the pin 4 (inverting pin) through R_3

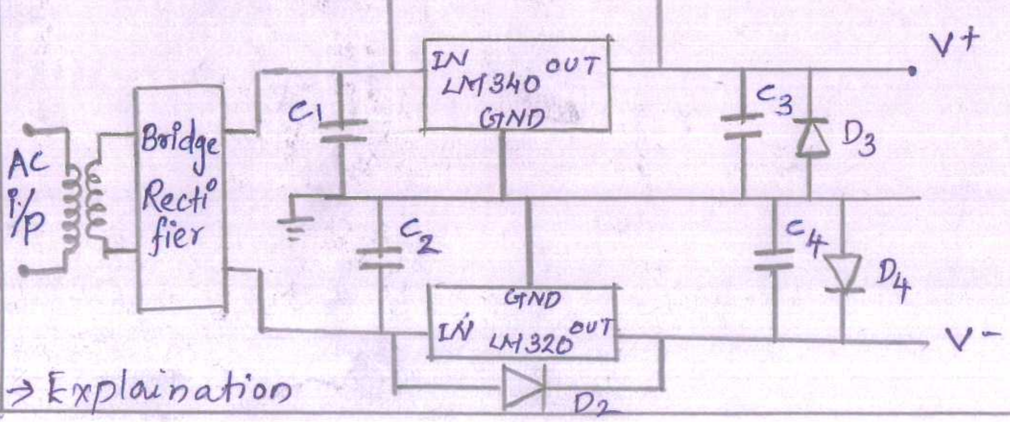
4½

→ when output voltage becomes low, the voltage at the inverting terminal of 723 [error amplifier] also goes down, hence the output of error amplifier becomes more positive., then Q_1 (Transistor) in to more conduction.

→ opposite action takesplace when the ouput voltage is increased.

$$V_{out} = V_{ref} \times \left[\frac{R_2}{R_1+R_2}\right]$$

(b)



3½

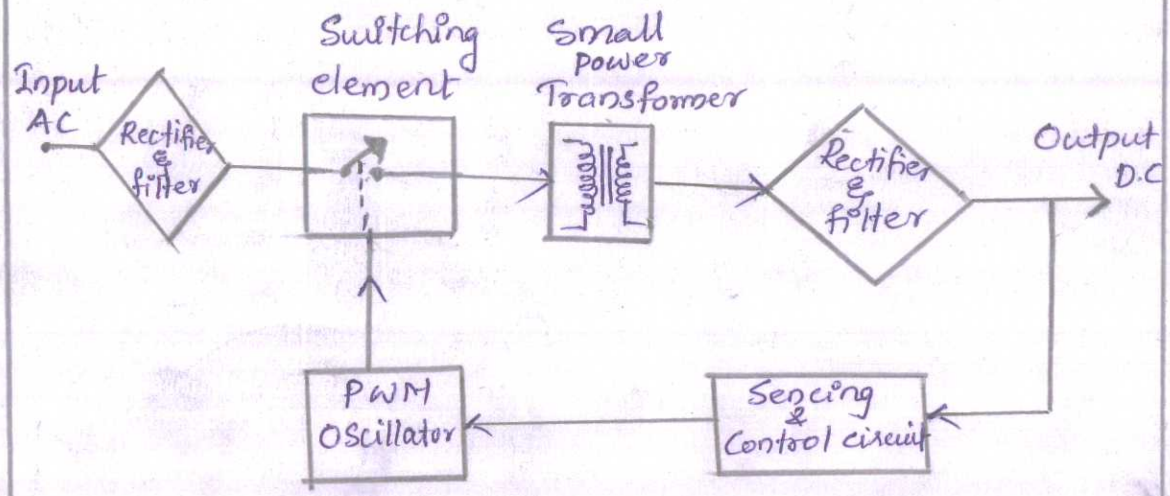
+ 7

3½

→ Explaination

OR UNIT – IV

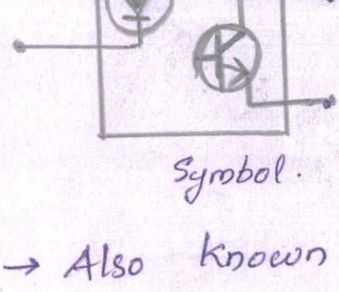
X (a) Block diagram of SMPS



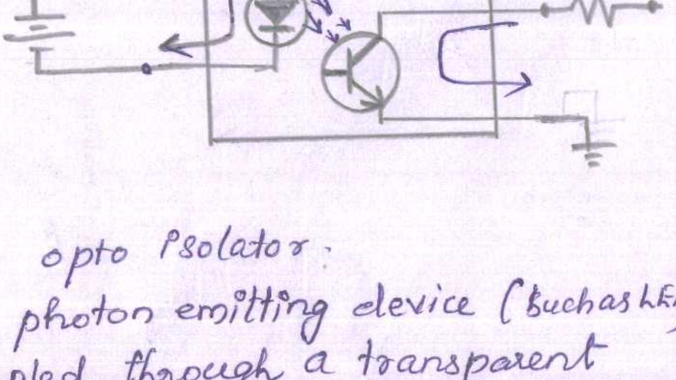
4

→ overcome the shortcomings of linear voltage regulator 8
→ used in most of the modern equipments
→ Switching element is driven by PWM oscillator
→ In SMPS, switching element is always operated in Switched Mode. ie either in Cut off or in the saturation region. 4
→ More efficient than linear
→ dissipate very little power.
→ can operate at low ac i/p.

(b)



Symbol.



2

→ Also known as opto isolator.
→ It consists of a photon emitting device (such as LED) whose flux is coupled through a transparent isolation materials (like air, glass, plastic) to some detectors (like, photo conductor, transistor.) 3 7
→ applications → interface between Sensors, couplings of signal between digital logic families, optical communication s/m etc. 2 60