MODEL QUESTION PAPER SET- 1 : 2021 - 22

ELECTRONIC - I (THEORY)

MM : 50 **SOLUTION** **Time : 3 Hrs**

Entire Syllabus

Q1. (A) Select the correct alternatives **4M**

(1) (a) shunt
(2) (a) Square
(3) (c) Active
(4) (a) Infinite

Q.1 (B) Answer Any Two from Following **6M**

(1) Define
(3 MARKS = 1 Mark for each)

(a) LAN: Local Area Network

A Local Area Network (LAN) is a private network that connects computers and devices within a limited area like a residence, an office, a building or a campus. On a small scale, LANs are used to connect personal computers to printers. However, LANs can also extend to a few kilometers when used by companies, where a large number of computers share a variety of resources like hardware (e.g. printers, scanners, audiovisual devices etc), software (e.g. application programs) and data.

(b) MAN: Metropolitan Area Network

A Metropolitan Area Network (MAN) is a larger network than LAN. It often covers multiple cities or towns. It is quiet expensive and a single organization may not have own it.

(c) WAN : Wide Area Network

A Wide Area Network (WAN) is a much larger network than LAN and MAN. It often covers multiple contries or contenants. It is quiet expensive and a single organization may not have own it. Satellite is used to manage WAN.

(2) Define Active & Passive transducer

Sol. **(1 mark for active transducer, 1 mark for active transducer 1 mark for example)**

Active transducers are the transducer which does not require external electric power source to convert any physical parameter into electrical. They are based on the principle of energy convert. Active transducers are known as self-generating transducer.

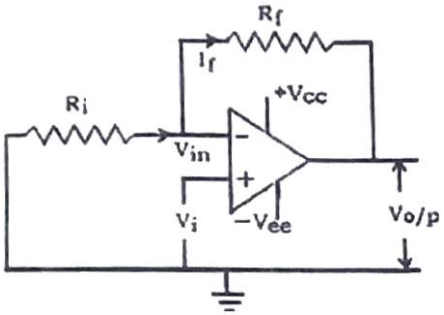
Example: 1) Photovoltaic cell. 2) Thermocouple 3) Piezo electric sensor

Passive transducer required external electric power source to convert physical parameter into electrical. They are based on the principle of energy control. They are not a self-generating transducer.

Example : 1) L.D.R., 2) Thermistor , 3) L.V.D.T.

(3) Draw & derive Op-Amp as Non Inverting Amplifier

Sol. In this circuit input signa1 V_i is applied to non-inverting input terminal while inverting input terminal is grounded through input resistor R_i. Output voltage is feedback to inverting input terminal through feedback resistor R_f.



Inverting input terminal receives the vaoltage V_{in} which is fraction of output vaoltage V_o and it is given by

Non-inverting amplifier is the amplifier whose output is in phase with the input. For an ideal ap-amp, open loop gain, A = ∞

Hence gain

$$A = \frac{V_O}{V_B - V_A} = \infty.$$

$V_B - V_A = 0$

$V_B = V_A = V_i$

As input impedance is $Z_i = \infty, i_b = 0.$

Applying KCL at A,

$i_i = i_b + i_f$

$i_i = i_f$ (as $i_b = 0$)

$$\frac{0 - V_A}{R_i} = \frac{V_A - V_o}{R_f}$$

$$\frac{0 - V_i}{R_i} = \frac{V_i - V_o}{R_f} \{\text{as } V_A = V_i\}$$

$$\frac{V_O}{R_f} = \frac{V_i}{R_f} + \frac{V_i}{R_i}$$

$$V_o = R_f\left|\frac{V_i}{R_f} + \frac{V_i}{R_i}\right|$$

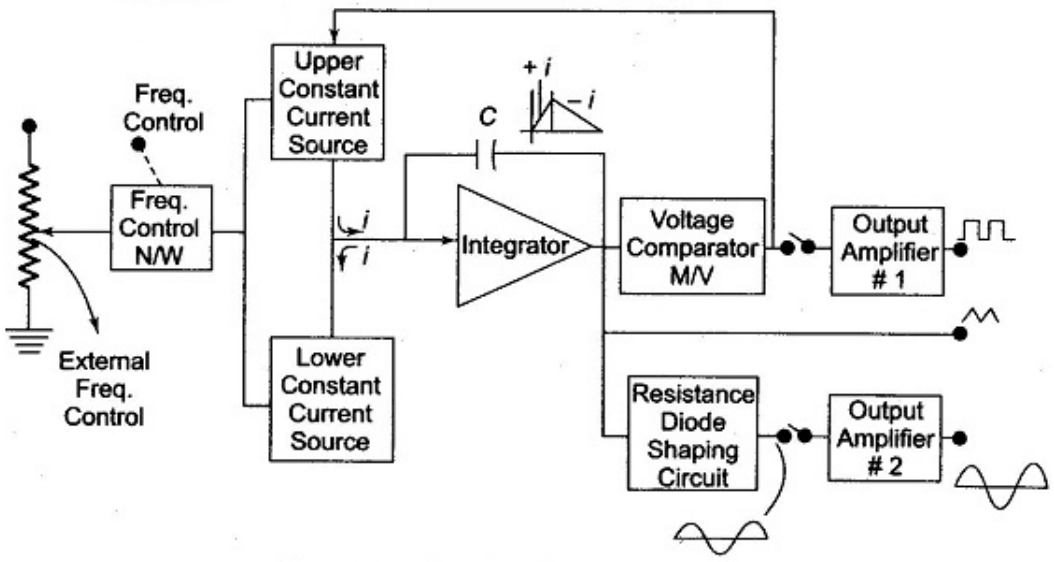
$$= V_i\left|\frac{R_f}{R_f} + \frac{R_f}{R_i}\right|$$

$$V_o = V_i\left|1 + \frac{R_f}{R_i}\right|.$$

Q.2 (A) Answer Any Two from Following **6M**

(1) Draw & Explain working of Function generator

Sol. Function generator is the versatile instrument that delivers different waveforms whose frequency can be adjusted over wide rage



It consist of (1) Frequency controlnetwork (2) Upper current source, (3) Lower current source (4) lntegrator, (5) Voltage comparator, (6) Resistor diode shaping circuit, (7) Amplifier.

The frequency control network is governed by frequency control knob which is on front panel. Frequency control voltage regulates the two current sources i.e. upper current source (UCS) and lower current source (LCS). Upper current source supplies constant current to integrator whose output increases linearly with time. The output voltage is given by

$V_{o/n} = -1/C\int Idt.$

An increase or decrease in current supplied by UCS increase or decrease the slope of output waveform (triangular wave).Voltage comparator changes state at predetermined level of positive slope. This change of state cut off UCS and switch on LCS.

Lower current source supplies reverse current to integrator due to which output voltage decreases linearly with time. When output voltage reaches to predetermine level of negative slope voltage comparator again switches arid cut off LCS and USC switched on.

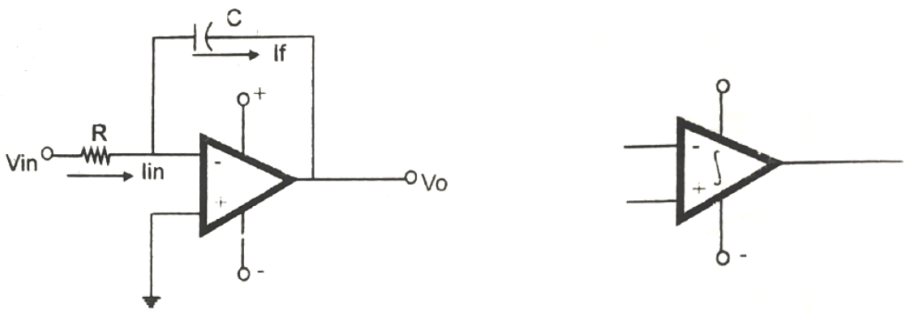
The voltage at output terminal of integrator is triangular wave whose frequency is determined by magnitude of current source.

Comparator i.e. multivibrator delivers square wave output having same frequency.

The third output wave form is delivered by resistor diode shaping circuit which synthesized triangular wave into sine wave.

The output circuitry consists of output amplifier which provides two simultaneous individually selected output of any one of wave form.

(2) Draw & Derive Op-Amp as Integrator



OP-AMP as an integrator

As shown in fig. OP-AMP integrator is obtained from differentiator by just interchangeing 'R' and 'C'

Derivation

$I_f = -Iin$

$I_f = -\dfrac{Vin}{R}$

But I_f is capacitive current it is $\dfrac{CdVo}{dt}$

$\therefore \dfrac{CdVo}{dt} = \dfrac{-Vin}{R}$

$\therefore dVo = -\dfrac{Vin\,dt}{RC}$

Integrating both side.

(3) In a Half wave rectifier, the secondary voltage is 25V. Calculate the DC load Voltage & load current for a load of 20 ohm

Sol. Given V_{rms} = 25V, R_L = 20Ω

(i) Peak secondary voltage

$$V_P = \frac{V_{rms}}{0.707} = \frac{25}{0.707} = 35.36\,V$$

(ii) Average DC Voltage

$$V_{DC} = \frac{V_P}{\pi} = \frac{35.36}{3.14}$$
$$= 11.25\,V$$

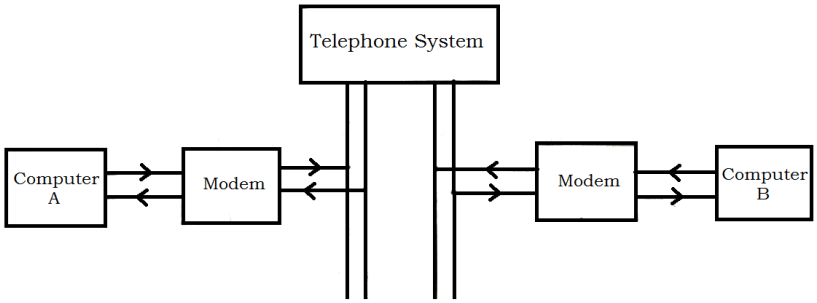
(iii) Load Current

$$I_L = \frac{V_{DC}}{R_L} = \frac{11.25}{20}$$
$$= 0.563\,\text{Amp}$$
$$= 563\,\text{mA.}$$

Q.2 (B) Answer Any one of following **4M**

(1) Draw & Explain Modem

Sol. Modem Process: Let us see how modem is functioning for digital communication between the two computer terminals located at two distinct (long distance) places. Refer Fig.



Digital communication between the two computers A and B is carried out in the following steps

1) The user at computer 'A' sends data in digital form

2) The computer 'A' is modulating digital data into analog form; the modulation technique may be FSK type

3) Modulated signal is within telephone frequency range. It is transmitted over telephone line by selecting a proper dial code.

4) The computer 'B' terminal is selected by its dial code.

5) The modem of computer 'B' is converting analog modulated signal into original digital data by the process of demodulation.

6) The demodulated digital information is processed and displayed on the screen of terminal B.

The opposite and similar action is carried out while transmitting the data from Computer 'B' to Computer 'A'. A simultaneous communication is possible by using two separate frequencies to avoid interference and to provide full duplex communications.

Applications of MODEM

Modems are specially designed for the following modern communication system; it is becoming more useful for

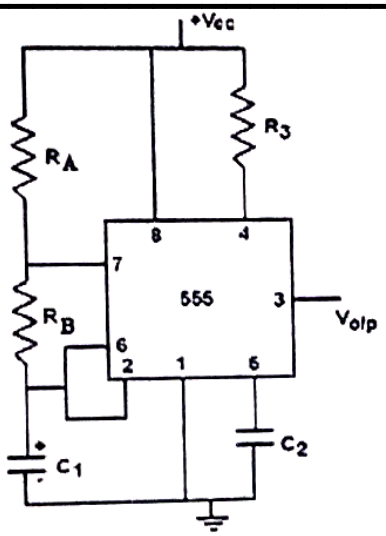
1) Fax communications
2) E-mail Communications
3) Chat Communications
4) Internet browsing

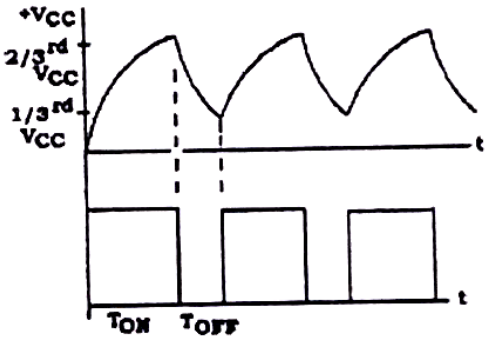
(2) Explain working of Astable Multivibrator

Sol. Astable multivibrator:

Theory: Astable multivibrator has no stable state; output changes its state between - high and low level. This multivibrator does not require external trigger pulse for transition of state, hence it is known as free running multivibrator.

Construction:- In this circuit trigger input and threshold input are connected to each other, control input terminal i.e. pin no 5 is grounded through a capacitor of 0.01 μf. To avoid false triggering reset input terminal is connected to $+V_{cc}$ through resistor of 10KΩ. Electrolytic capacitor is connected to pin no 2 and it is charged to $+V_{cc}$ through a resistors R_A and R_B while it is discharged through resistor R_B and discharge transistor (pin no 7).





Working: When power supply is switched on at the initial stage capacitor potential is zero. This potential is applied to trigger input terminal which is less than reference potential hence trigger comparator becomes active and gives reset pulse to RS flip flop due to reset pulse output of flip flop becomes low but output of IC becomes high. Due to low output discharge transistor behaves like open circuit and it gives infinite resistance to pin no 7. The result of this capacitor is connected to +Vcc through resistors RA and Rs and start charging. This charging time is given by

$T_{ON} = 0.693(R_A + R_B)C$

When charging potential of capacitor reaches to +2/3 Vcc threshold comparator becomes active and gives set pulse to RS flip flop. Now due to set pulse output of flip-flop becomes high but output of IC becomes low. As output of flip-flop is high discharge transistor conducts and gives low resistance path to capacitor due to which capacitor start discharging. This discharging time is given by

$T_{OFF} = 0.693(R_B)\ C$

When discharging potential of capacitor reaches to 1/3 Vcc once again trigger comparator becomes active and output of IC becomes high. This process is continuous and it does not requires trigger pulse for each transition of state hence this multivibrator is known as free running multivibrator.

The total time is given by

$T=T_{ON} + T_{OFF} = 0.693(R_A+ R_B)\ C + 0.693(R_B)\ C$

$T = 0.693\ (R_A + 2R_B)C$

Frequency of astable multivibrator is given by

$F = 1 / T = 1 / 0.693\ (R_A + 2R_B)\ C$

$F = 1.449 / (R_A + 2R_B)\ C$

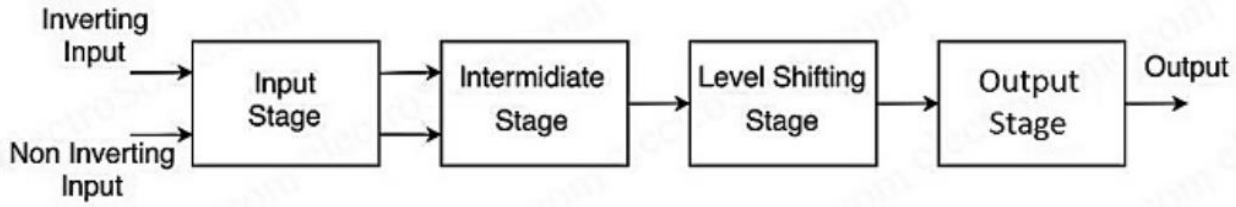
Duty cycle :- Duty cycle is the ratio of on time (T_{ON}) to total time (T). Duty cycle can be adjusted by changing the value of R_1 and R_2

$$\text{Duty cycle} = \frac{T_{ON}}{T}\times 100 = \frac{0.693(R_A+R_B)C}{0.393(R_A+2R_B)C}\times 100 = \frac{(R_A+R_B)}{(R_A+2R_B)}\times 100$$

Q.3 (A) Answer Any Two from Following **6M**

(1) Explain Block Diagram of OP-AMP

Sol.



1) First stage differential amplifier (Input stage): This is the first stage of amplifier which is dual input balanced output differential amplifier. This stage determines gain, rejection of common input signal, it provides high input impedance and this stage provides low input offset voltage and bias current.

2) Second stage differential amplifier (Intermediate stage): It is also known as intermediate state amplifier which is driven by output of first stage. This stage provides additional gain, differential mode gain of this amplifier is very high. The total gain is about 10^6, common mode gain is zero. There is no effect of temperature and voltage fluctuation.

3) DC level shifter and emitter follower: As DC level increases through amplifier it is necessary to compensate that DC level. Output of second stage differential amplifier is much larger than OV DC level; hence it is brought down to with the help of this circuit. This circuit is not directly connected to output because it loads amplifier, hence emitter follower is introduced in this circuit.

4) Output power amplifier (Output stage): This amplifier provides high current gain, wide bandwidth, and low output impedance. Basically push-pull amplifier is used in this stage.

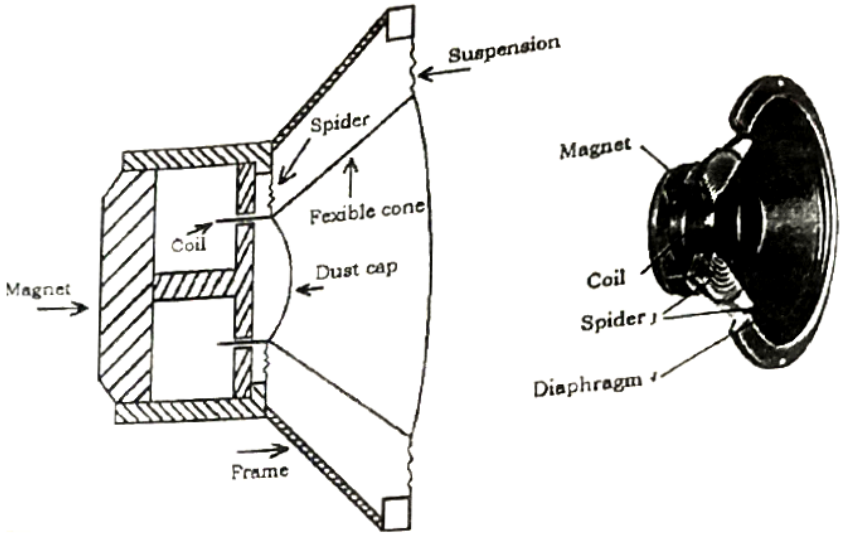
(2) Explain Working of Loud speaker

Sol. **Principle:** A conductor carrying electric current placed in magnetic field of induction experiences a force.

Loud speaker consist of following main parts

(1) Permanent magnet, (2) Voice coil, (3) Spider, (4) Flexible cone, (5) Dust cap, (6) Frame.

1) Permanent magnet:- A very strong permanent magnet which is made by an alloy of Aluminum, Nickel, and Cobalt is known as Alnico. This magnet produces very strong magnetic field.



2) Voice coil: It consist of few turns of copper wire wounded on insulating base like mica, cardboard etc... This coil is suspended in magnetic pole by using special device known as spider.

3) Spider : It is flexible membrane made up of specially prepared cloth. This spider is fixed to the coil from one end and to frame from other end. The spider is used to keep voice coil properly center in air gap between magnetic poles.

4) Flexible cone: It is made from special paper. The outer edge of paper is fixed to the main frame known as basket. The inner edge is connected to the voce coil. The cone is vibrating element which produces sound wave.

5) Dust cap: - It is used to protect the voice coil from dust particles. It does not allow dust particles to enter in the air gap.

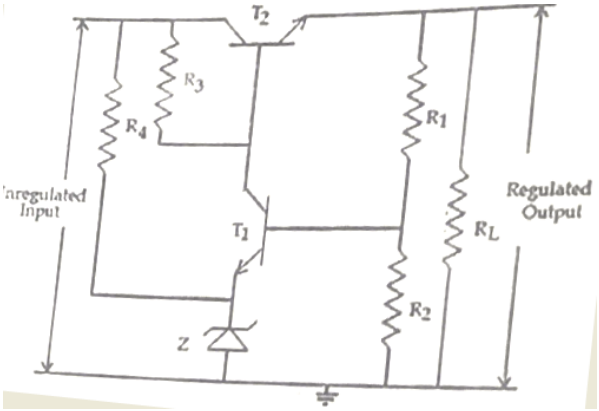
6) Frame:- Frame is made from iron. It used as base for above assembly, it is also used to mount speaker on the cabinet of wooden box of the instrument.

The loud speaker is known as acoustic transducer which is used in communication field. When electric signal is applied to the coil it get magnetized and start vibrating due to this paper cone is also vibrates and produces sound wave.

Application:- is used for reproduction of sound.

(3) Derive & Draw – Explain voltage regulator

Sol. In transistorized regulator negative feedback is used to hold output voltage almost constant regardless of any change in input voltage or load current.



Required clear straight image

Construction:- In this circuit transistor T_2 is an emitter follower, this transistor is also known as series pass transistor because all the load current passes through it and it is connected in series with load.

Voltage divider arrangements formed by resistor R_1 and R_2 samples the output voltage and deliver the feedback voltage to the base of transistor T_1. This feedback voltage controls the collector current of transistor T_1.

Working: - If output voltage increases more amount of feedback voltage is applied to base of transistor T_1. Now transistor T. produces more current which passes through resistor R. and provides less base voltage to transistor T_2, the result of this emitter current of T_2 decreases and hence it provides less output voltage.

If output voltage decreases there is less base voltage applied to transistor T_1, hence collector current of T_1 decreases but base voltage of transistor T_2 increases hence emitter current of To increases. The result of this output voltage also increases.

From this we can conclude that an attempted change in output voltage produces an amplified output change in opposite direction and effect of all this we get constant output across load.

Limitation: -I) When load current increases series pass transistor dissipates more amount of power and to dissipate that power heat sinks are required.

2) Power dissipation of circuit is depends upon series pass transistor

3) Heat sinks are required due to which cost, size and weight of power supply is increased

Expression for output voltage is

$V_{o/p}$ = Act (V_z + V_{BE})

$$V_{o/p} = \left(1+\frac{R_1}{R_2}\right)(V_Z+V_{BE})$$

As feedback fraction or A_{ct} is constant as well as V_{BE} is also constant output voltage depends upon Zener voltage.

$\therefore V_{o/p} = V_z$

Q.3 (B) Answer Any one of following **4M**

(1) A 25V, 500mW zener diode is used for providing a 25 Zener Voltage regulator is 25V stabilized supply to variable load. If the input voltage is 40 calculate series Resistance 'RS' required when RL = 5kohm.

Sol. (i) Maximum zenser current $I_{Z(max)} = \frac{P_Z}{V_Z} = \frac{500_m W}{25V} = 20mA$

(ii) $V_{RS} = V_{in} - V_0 = 40-25 = 15V$

(iii) $I_L = \frac{V_0}{R_L} = \frac{25V}{5K\Omega} = 5mA$

$R_S = \frac{V_{RS}}{I}$ where $I = I_Z + I_L = 20+5 = 25mA$

(iv) $R_S = \frac{15}{25mA} = 0.6\times10^3\Omega$

Rs = 600Ω

(2) Explain with any 3 front panel controls of C.R.O.

Sol. a) Intensity: - It is used to control the brightness of electron beam by adjusting the negative potential applied to control grid of CRT.

b) Focus: - It is used to adjust the sharpness of electron beam by controlling positive potential applied to focusing anode of CRT.

c) Volts/Div.:- It is used to adjust the height of electron beam (waveform) to get sufficient display of waveform. This knob actually adjusts the gain of vertical amplifier.

d) INT/EXT:- When only Y input is applied to CRO This knob is kept at INT mode. In INT mode internal sweep generator is connected to horizontal amplifier. In EXT mode external X input is directly applied to horizontal amplifier.

e) Time /Div.: - 18 to 20 position switch is used to adjust the frequency of saw tooth wave form by connecting different values of capacitor to the emitter circuit due to which width of waveform (divisions along X axis) can be adjusted in such a way that 1 or 2 complete cycles can be displayed on CRT screen.

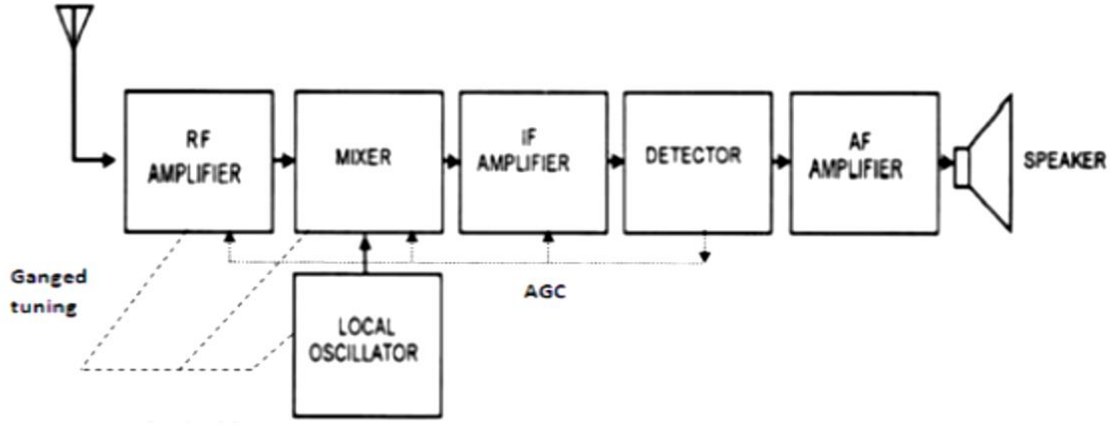
f) AC-GND-DC: - It selects the input coupling as per the input. If it is at ground mode the input signal gets grounded through the CRO and as there is no input signal to CRT we get only horizontal straight line.

g) Y input: - The actual input signal which is to be studied is applied through this terminal as Y-input.

Q.4 (A) Answer Any Two from Following **6M**

(1) Draw & Explain Working of Superheterodyne receiver

Sol:



The receiver circuit can be divided in to the following stages

i) Antenna: It intercepts radio electromagnetic waves transmitted by various radio stations and converts them into electrical waves.

ii) RF Stage: It is a tuned RF amplifier having L-C parallel tuned circuit, it performs two important functions. a) It selects the desired station frequency b) It amplifies weak received signals.

Mixer Stage: The amplified tuned frequency is converted into a medium fixed frequency known as intermediate frequency (IF) by mixing it with an appropriate local oscillator frequency. This action is known as heterodyne action.

iv) IF stage: The output of the mixer (IF) is amplified by using two or more IF amplifiers to get better selectivity, sensitivity and fidelity.

v) Detector stage: The output of IF amplifier is a modulated signal, it is demodulated by this circuit and detects audio information. This stage is also Windows known as demodulator stage.

(2) Explain Application of C.R.O.

Sol. Application of CRO are

1) Electronic laboratory:

(A) Voltage measurement (a) AC voltage, (b) DC voltage.

(B) Frequency measurement, (C) Phase measurement, (D) Study of lissajous pattern,

(E) Current measurement, (F) Component testing, (G) Study of physical parameters.

2) Medical laboratory, (3) In RADAR system, (4) Television, (5) Industry.

1) DC Voltage measurement: - The procedure for DC voltage measurement is

1) Keep selector knob on DC mode.

2) Adjust $\frac{\text{Time}}{\text{Div}}$ knob in such a way that steady horizontal line is obtained on the screen.

3) By using vertical position control adjust horizontal line on X axis, so that it can be considered as base line.

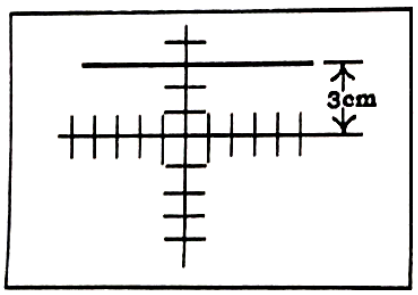
4) Apply unknown DC potential to Y- input terminal of CRO.

5) Now original line is shifted either in upward direction or in downward direction. Measure number of divisions of shifted line from base line (a).

6) Find out the position of $\frac{\text{Volts}}{\text{Div}}$ (b) knob.

7) Product of the division (a) and $\frac{\text{Volts}}{\text{Div}}$ (b) gives the actual value of applied unknown DC potential

For example



If $\frac{\text{Volts}}{\text{Div}}$ is at $\frac{5V}{cm}$ then we get

$V_{DC} = 3cm \times \frac{5V}{cm}$

$V_{DC} = 15V$

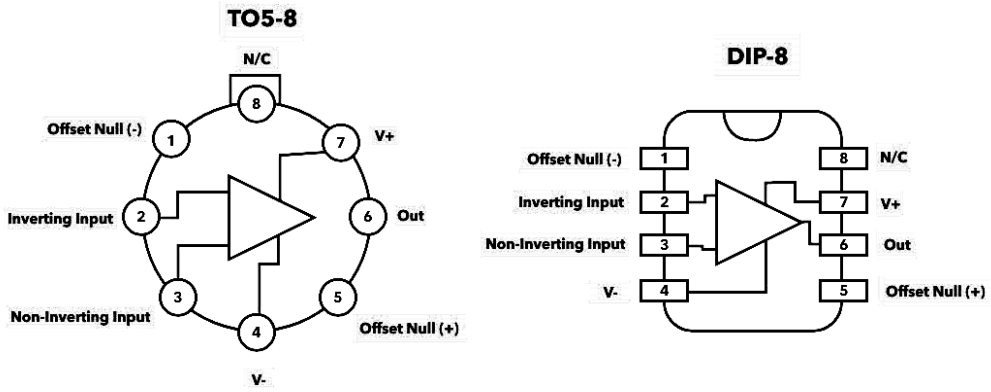
As line is shifted in upward direction applied voltage is positive.

2) Current measurement: CRO is also used to measure current flowing through the circuit, but unfortunately there is no direct provision for current measurement hence the potential drop across known resistance is measured by using CRO, then by using ohms law the amount of current flowing through the circuit is calculated.

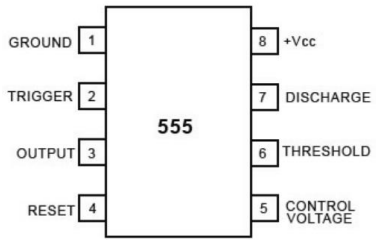
3) Component testing: Some electronic components are also tested by using CRO. When the leads of components are inserted in the input terminal various patterns are displayed on the screen this patterns are compared with standard pattern given by manufacturer. If these patterns are matched then the components are in working condition.

(3) Draw Pin diagram & Symbol of IC-

Sol. (1) 741



(2) 555



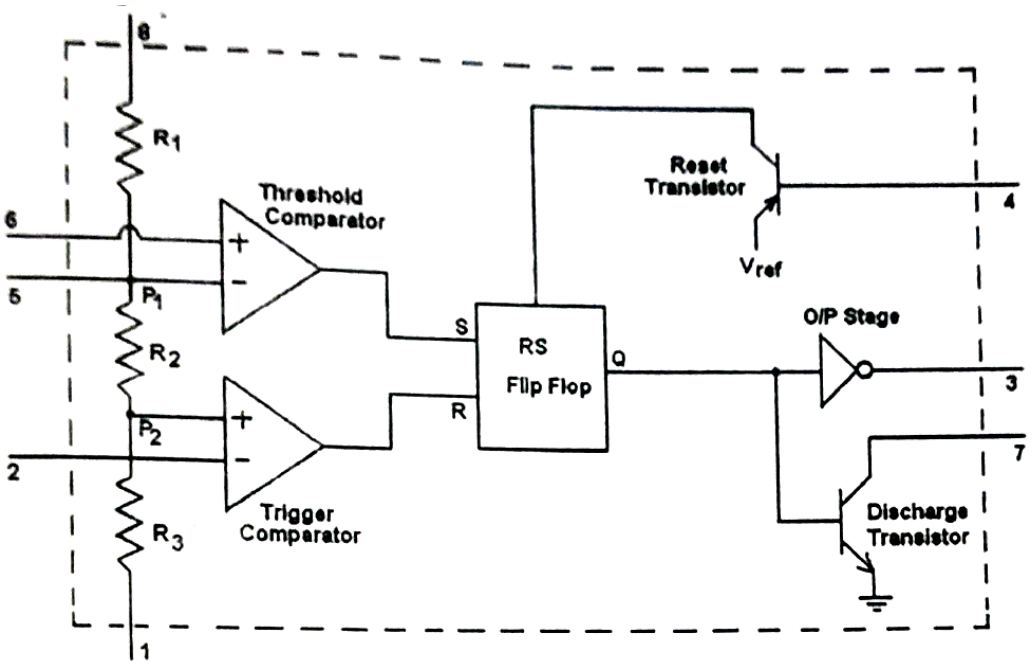
Supply range: 3V to 18V ; Maximum load Current 200mA

Q.4 (B) Answer Any one of following 4M

(1) Explain Internal Block Diagram of IC – 555

Sol: IC 555 is most versatile IC used in number of useful applications. This IC is also known as timer type IC. It is available in 8 pin DIP and 14 pi DIP.

Functional diagram.



Three equal value resistors R_1, R_1, R_3 are connected between pin no 8 and pin no 1 serve as internal potential divider arrangement. The 1/3rd Vcc will appears across each resistor. The potential drop developed across point P_1 and P_2 serve as reference potential for threshold and Trigger comparator. Comparators are basically operational amplifier which changes their state when input voltage overcomes reference voltage. Reference voltage for trigger comparator is 1/3rd Vcc while for threshold comparator it is $2/3^{rd}$ Vcc.

As trigger comparator is inverting comparator when input voltage applied to inverting terminal drops below reference voltage ($1/3^{rd}$ Vcc) output of comparator becomes high, while threshold comparator is non-inverting comparator when input applied to non-inverting terminal rises above reference voltage (2/3rd Vcc) output of comparator becomes high.

Output of comparators is connected to input terminals of RS flip flop. Output terminal of threshold comparator is connected to set terminal of Flip flop while output of trigger comparator is connected to reset terminal of flip flop.

When trigger voltage falls below reference voltage output of trigger comparator becomes high which gives reset pulse to flip flop due to which output of flip flop becomes low. As output stage (Inverter) is connected between flip flop and output terminal output of IC becomes high. This output state is known as on state. At this state due to low output of flip flop discharge transistor remains in off state and behave like open circuit, the result of this discharge terminal has very high input impedance.

When threshold voltage rises above reference voltage output of threshold comparator becomes high which gives set pulse to flip flop. Due to set pulse output of flip flop becomes high but due to output stage output of IC becomes low. But as output of flip flop is high discharge transistor get required biasing potential and conduct and it behaves like short circuit hence internal resistance of discharge terminal drops to zero.

From this it is clear that when trigger potential drops below reference voltage ($1/3^{rd}$ Vcc) output of IC becomes low and discharge terminal has high input impedance. When input potential applied to threshold comparator rises above reference potential output of IC becomes low while internal resistance of discharge terminal becomes very low.

Pulse	Set	Reset	Output of Flip flop	Output of IC
X	----	----	Last state	----
Trigger	Low	High	Low	High (On)
Threshold	High	Low	High	Low (Off)

(2) Explain Term

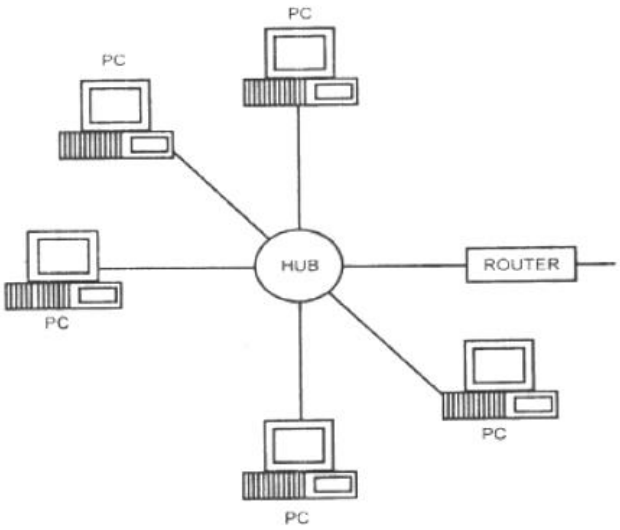
Sol. (a) Star Topology :

(1) In a STAR topology, all the workstations are connected to a central hub.

(2) The hub receives a signal from a workstation and routes it to the proper destination.

(3) STAR physical topology is often implemented to implement BUS or RING logical topology.

(4) A STAR topology is shown in the following figure:



Advantages:

(1) Adding a new workstation is easier than that ¡n BUS or RING topology.

(2) The control is centralised due to use of a hub

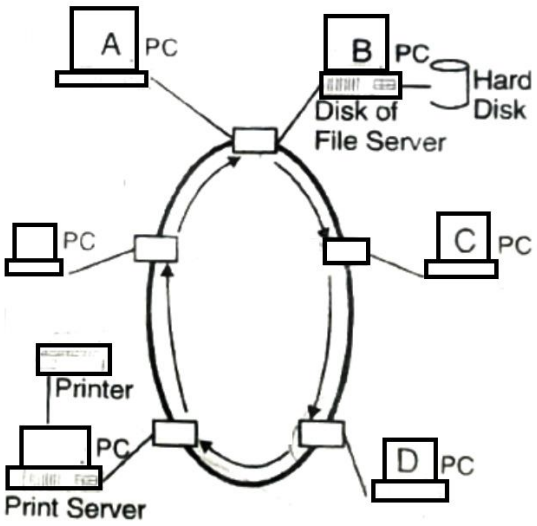
Disadvantages:

(1) Hub failure affects all users.

(2) Hubs are slightly expensive.

(3) STAR topology requires more cabling than BUS or RING topology. Hence, it costs more.

(b) Ring topology : The ring topology is shown in fig. Where server is not centrally located. The network is formed by a number of stations with server connected one after the other forming a ring route.



Each node receives data from the ring in sequence; the data is addressed in order to get the data to the desired node. In ring topology, each node is using the common ring to transmit or receive data. Suppose node A has to transmit to the node D then it is passed from A to B, B to C and

then C to D the node B and C will check the address if the address is not for them they retransmit data to the next neighbouring station.

The main advantage of ring topology is that each node has direct communication capacity and it is independent on one control node. When one terminal fails the whole system fails. On the other hand its total delay in communication depends on the number of nodes and if the nodes are many in the ring more delay is introduced while communicating the data from one station to other station. This is the only drawback of ring topology but it is more reliable than star topology.

(c) Bus Topology: This topology is more efficient and reliable than the star and ring topology. This topology is also known as a multi-point or multi-drop topology because in this interconnection method a common bus is used for data transmission with bi directional communication provided by the bus for each node. The bus is available for each node to send its data to each and every computer node if desired.

Advantages

1) The bus system is much faster than other methods.

2) Direct communication between the two stations without any control station.

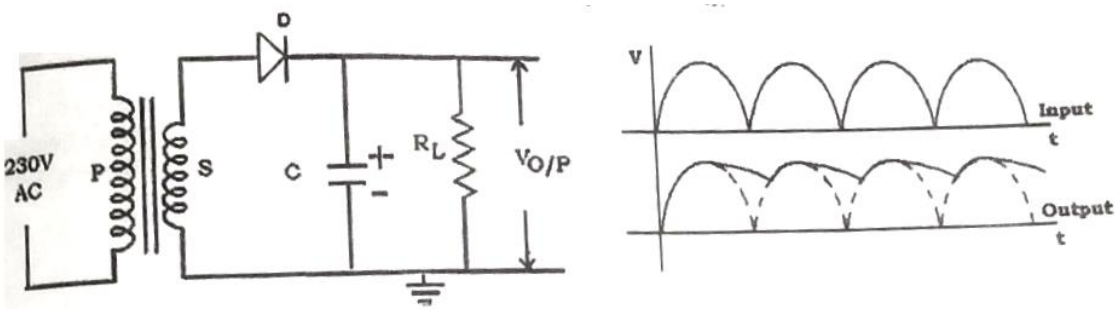
3) The bus topology can be extended with sub branches to form another topology known as tree topology.

4) Break down of any failure node does not affect other node's communication. Bus topology widely used in wide LAN network.

Q.5. (A) Answer Any Two from Following **6M**

(1) Explain Working of Shunt Capacitor Filter

Sol.



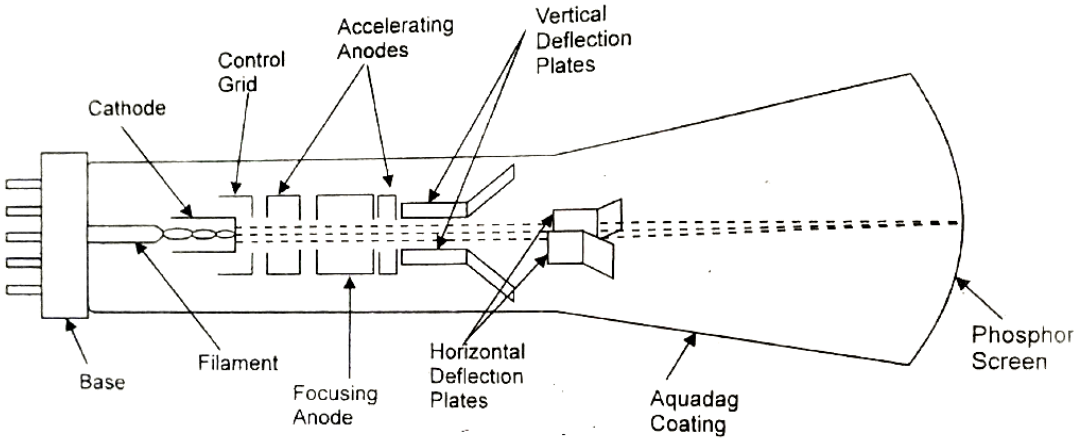
This is the simplest and cheapest filter circuit widely used in electronic power supply. A large value capacitor is connected across the rectifier output in shunt with load. Capacitor offers low reactance to AC and high reactance to $DC\left(X_C = \frac{1}{2\pi FC}\right)$ due to which Ac components are passes through it and appears across ground while DC components are blocked.

The pulsating DC is applied across the capacitor. As output voltage increases it charges capacitor and supplies current to the load resistor R_1. At the end of quarter cycle capacitor charges to maximum value, after this peak point output voltage of rectifier starts decreasing due to which capacitor discharges through load. The voltage across load decreases slightly because immediately next voltage peak arrives and recharges the capacitor. This process is continuous and thus AC components gets bypassed and only DC components are available across load resistor.

(2) Draw & Explain CRT

Sol. As illustrated in fig., CRT consists of an electron gun, deflecting plates, and fluorescent screen inside an evacuated glass envelope. The electron gun fires electrons at a very high speed and are emitted from cathode. Number of electrons emitted from the cathode is controlled by control grid, which is marked on the front panel of CRO as 'INTENSITY Control grid controls the

brightness with variable negative voltage; its function is same as that in triode. These electrons coming out of control grid are then accelerated by accelerating anode known as accelerating anode. then focusing anode where sharpness is controlled with variable positive voltage and it is marked as 'FOCUS' on CRO front panel. Focusing method is known as electrostatic lens system. A sharp beam is displayed when the focal length of this lens system is adjusted by focusing anode voltage.



CRT construction

The focused beam then passes through deflection plate assembly, which consists of a pair of parallel plates; these are Y-deflection plates or vertical deflection plates and X-deflection plates or horizontal deflection plates. In CRO the signal, which is to be displayed, is generally fed to Y-plates and internal time base voltage to X - plates.

(3) In a IC 555 monostable multivibrator a resistance of 50Kohm is connected with a capacitor of 100 micro farad. Find its time delay

Sol. $R = 50K\Omega = 50 \times 10^3\Omega$; $C = 100\ \mu f = 100 \times 10^{-6}$ f

Formula : $t = 1.1\ RC$

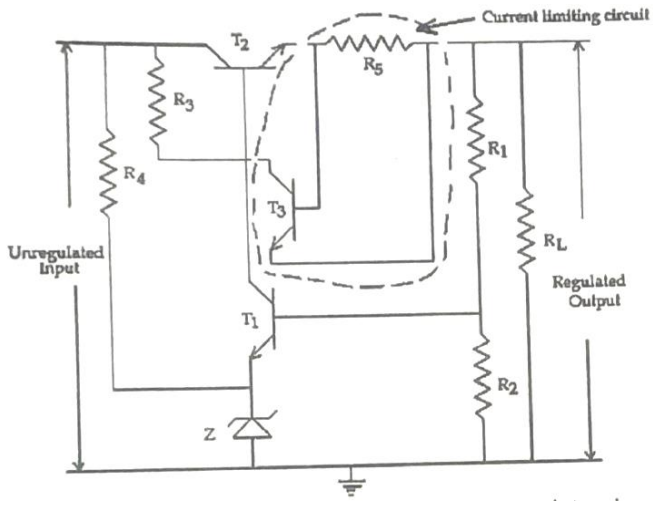
$= 1.1 \times 50 \times 10^3 \times 100 \times 10^{-6}$

$t = 5.5$ seconds

Q.5 (B) Answer Any one of following **4M**

(1) Draw & Explain Transistorized voltage regulator with current limiting action.

Sol. If output terminal of power supply is accidentally short circuited then load current increases dangerously to high level. This current may destroy series pass transistor as well as Zener diode. Hence it is necessary to control load current and for that purpose current limiting circuit is introduced in transistorized series regulator.



In this circuit resistor R_5 is current sensing resistor is used with transistor T_3 to limit load current to required amount. If value of R_5 is 1Ω then current less than 600mA produces potential drop which is less than. 6V, this potential is not sufficient to bias the transistor T_3 and it remains in off state.

If load current increases due to short circuit and it goes above 650mA the potential drop across resistor Rs becomes more than 65V and hence transistor T_3 conducts due to which current conduction takes place through collector of T_3. As this current flow through resistor R_3 potential across base of transistor T_2 decreases due to which the load current also decreases hence output voltage is also decrease. Thus current limiting circuit does not allow increasing load current more than 600mA

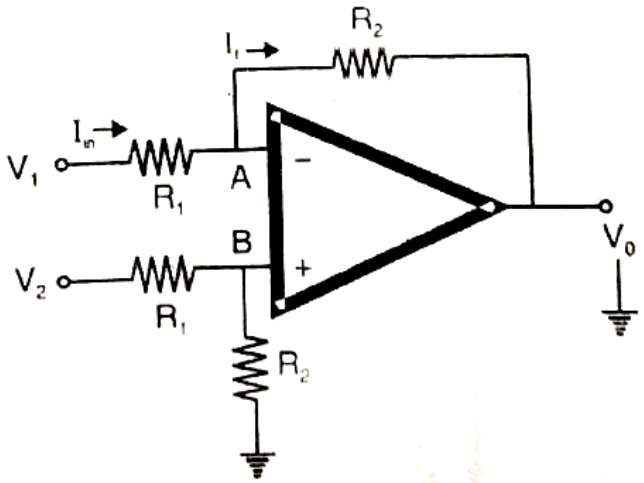
To get more amount of constant load current value of Rs is adjusted in such a way that the potential drop across R_5 should be only 0.6V for that required current value.
Power dissipation in series pass regulator is given by

$P_D = V_{CE} \times I_L$ Where V_{CE} is collector emitter voltage of transistor and I_L is load current. In series regulator when load current is high series pass transistor has to dissipate more power and for that purpose large heat sinks are required. Due to heat sinks size weight and cost of the instrument increases.

(2) Explain Working of op-Amp as Subtractor

Sol. A subtractor circuit is a basic differential amplifier action of OPAMP as shown in fig. The two inputs V_1 and V_2 are connected to the inverting and non-inverting terminals of OPAMP. It performs the subtraction $(V_2 - V_1)$.

Figure shows the circuit of subtractor. The two inputs V_1 and V_2 are connected to the inverting and non-inverting terminals of OPAMP.



OPAMP - Subtractor

Derivation : Because of high input impendance, the current entering into OPAMP is.

$\therefore$ Potential at point B is $V_B = \left(\frac{R_2}{R_1 + R_2}\right) \times V_2$ and $I_{in} = I_f$

$$\frac{V_1 - V_A}{R_1} = \frac{V_A - V_0}{R_2}$$

As open loop gain of OPAMP is very high.

$V_0 = A(V_A - V_B) A \to \infty \qquad V_A = V_B$

(From virtual ground concept)

$$\therefore \frac{V_1}{R_1} - \frac{R_2}{R_1 + R_2} \times \frac{V_2}{R_1} = \frac{R_2}{R_1 + R_2} \times \frac{V_2}{R_2} - \frac{V_0}{R_2}$$

$$\therefore \frac{V_1}{R_1} - \frac{R_2}{R_1 + R_2} \times \frac{V_2}{R_1} - \frac{R_2}{R_1 + R_2} \times \frac{V_2}{R_2} = - \frac{V_0}{R_2}$$

$$\therefore \frac{V_1}{R_1} - \frac{V_2}{R_1 + R_2} \left(\frac{R_2}{R_1} + 1 \right) = - \frac{V_0}{R_2}$$

$$\therefore \frac{V_1}{R_1} - \frac{V_2}{R_1 + R_2} \left(\frac{R_1 + R_2}{R_1} \right) = - \frac{V_0}{R_2}$$

$$\therefore \frac{V_1}{R_1} - \frac{V_2}{R_1} = - \frac{V_0}{R_2}$$

$$\therefore V_0 = - \frac{R_2}{R_1} (V_1 - V_2)$$

$$\therefore V_0 = \frac{R_2}{R_1} (V_2 - V_1)$$

If $R_1 = R_2$, $V_0 = V_2 - V_1$

Thus, the output is difference between two input voltage.

Together we will make a difference