KLS Vishwanathrao Deshpande Institute of Technology

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

University / Model Question Paper Scheme & Solution

Faculty Name	:	Prof. Vijayalaxmi C Kalal
Course Name	:	Introduction to Electronics & Commⁿ
Course Code	:	BESCK204C
Year of Question Paper	:	June/July 2025
Date of Submission	:	02/02/2026

Faculty Member HoD Dean (Acad.)

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG ★ KLS VDIT HALIYAL

CBCS SCHEME

USN | | | | | | | | | | |

BESCK204C

Second Semester B.E./B.Tech. Degree Examination, June/July 2025
Introduction to Electronics and Communication

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	With a neat diagram, explain the working of a DC power supply. Also mention the principal components used in each block.	10	L2	CO1
	b.	With circuit diagram and waveform explain the working of full wave rectifier.	10	L2	CO1
		OR			
Q.2	a.	List and describe the main types of amplifiers.	7	L2	CO1
	b.	With circuit diagram explain the following voltage doubler, voltage Tripler.	6	L3	CO1
	c.	Mention the advantage of negative feedback in amplifier circuit with relevant equations and diagram. Explain the concept of negative feedback.	7	L2	CO1
		Module – 2			
Q.3	a.	List and explain the conditions to obtain sustained oscillations. Determine the frequency of oscillations of a 3 stage ladder network in which C = 10 ηF and R = 10 KΩ.	10	L3	CO2
	b.	With circuit diagram and waveform show how operational amplifier can work as a comparator and voltage follower.	10	L3	CO2
		OR			
Q.4	a.	With neat circuit diagram explain the working of Wein Bridge oscillator.	10	L2	CO2
	b.	Sketch the circuit of each of the following based on the use of operational amplifier. i) Inverting amplifier ii) Differentiator	10	L2	CO2
		Module – 3			
Q.5	a.	Explain with circuit diagram of full adder.	6	L2	CO3
	b.	Given the two binary numbers X = 1010100 and Y = 1000011 perform the subtraction i) X – Y ii) Y – X using 2's complement.	6	L3	CO3
	c.	Convert the following number from the given base to the other bases identified : i) Decimal 225 to binary ii) Binary 11010111 to octal iii) Octal 623 to decimal iv) Hexadecimal 2AC5 to decimal.	8	L2	CO3
		OR			
Q.6	a.	Express the Boolean function $F_1 = A + B'C$ in a sum of minterms form and $F_2 = XY + X'Z$ in a product of maxterms form.	10	L3	CO3
	b.	Design a full adder using two half address and on OR gate.	10	L3	CO3

		Module – 4			
Q.7	**a.**	Compare embedded systems and general computing systems and also provide major application areas of embedded system.	**10**	**L2**	**CO4**
	b.	Bring out the differennce between RISC and CISC, microprocessor and microcontrollers.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	Draw the basic block diagram of instrumentation and control system. Also explain feedback based control system.	**10**	**L2**	**CO4**
	b.	With neat diagram explain the working of LED and 7 segment display.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	With neat diagram explain the basic blocks used in communication system.	**10**	**L2**	**CO5**
	b.	Explain the need for modulation and explain briefly the types of modulations used for communication.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	What are the advantages and disadvantages of digital communication over analog communication?	**10**	**L2**	**CO5**
	b.	With neat diagram explain the working of time division multiplexing and frequency division multiplexing.	**10**	**L2**	**CO5**

* * * * *

1a. With a neat diagram explain the working of DC power supply Also mention the principal components used in each blocks.

Ans: Power supply is a device that supplies electric power to a load. The following is the block diagram of the power supply

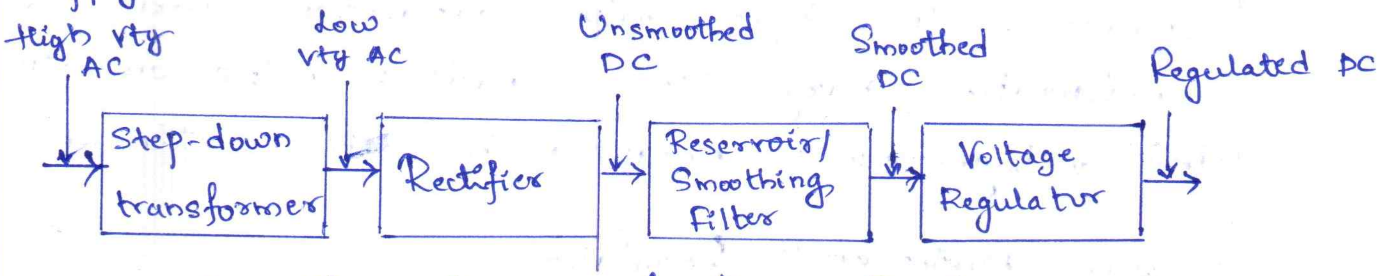


Fig: Block diagram of Power Supply

The components used in each of the blocks are shown in the diagram below.

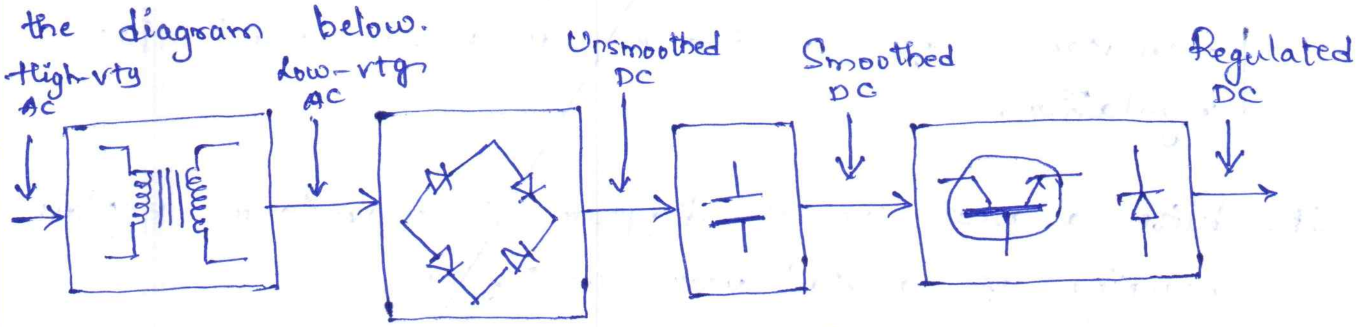


Fig.: Components of Power Supply Blocks.

Step-Down Transformer :-

Steps down the AC main voltage which is usually high (220V) to a lower value (9V, 12V, 15V, 20V, 30V). This is achieved by varying the turns ratio on the transformer.

Rectifier :-

The AC output from transformer secondary is then rectified using conventional silicon rectifier diodes to produce an unsmoothed output (pulsating DC). Rectification is generally achieved using a bridge rectifier which used four diodes connected in the form of a bridge.

Reservoir / Filtering Circuit :-

The unsmoothed output from rectifier is smoothened by reservoir/ filtering circuit (a high value capacitor). The high value capacitor stores a considerable charge. The capacitor helps smooth out the voltage pulses produced by the rectifier.

Voltage ~~Rectifier~~ :- Regulator :-

This provides a fixed voltage source stabilizes & provides a constant voltage. A series transistor regulator using a zener diode is used for voltage regulation.

1b. With a neat circuit diagram & waveform explain the working of a full wave rectifier.

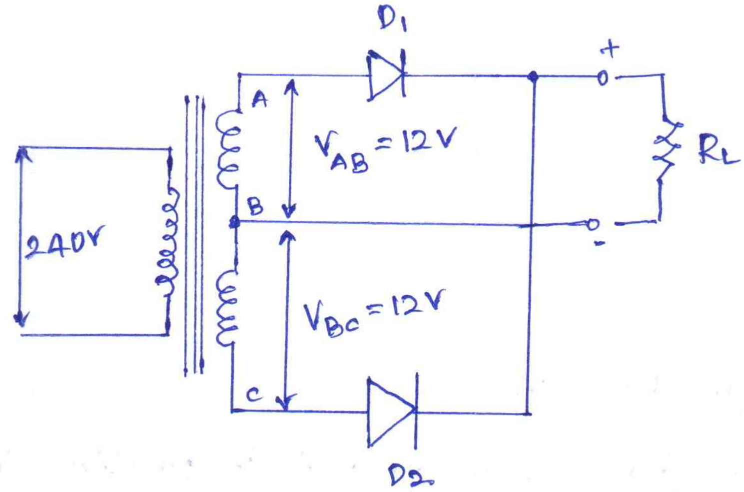
Ans. A full wave rectifier is a type of rectifier that conducts during both the half cycles of the input signal. There are two types of full wave rectifiers.

a). Biphase full wave rectifier

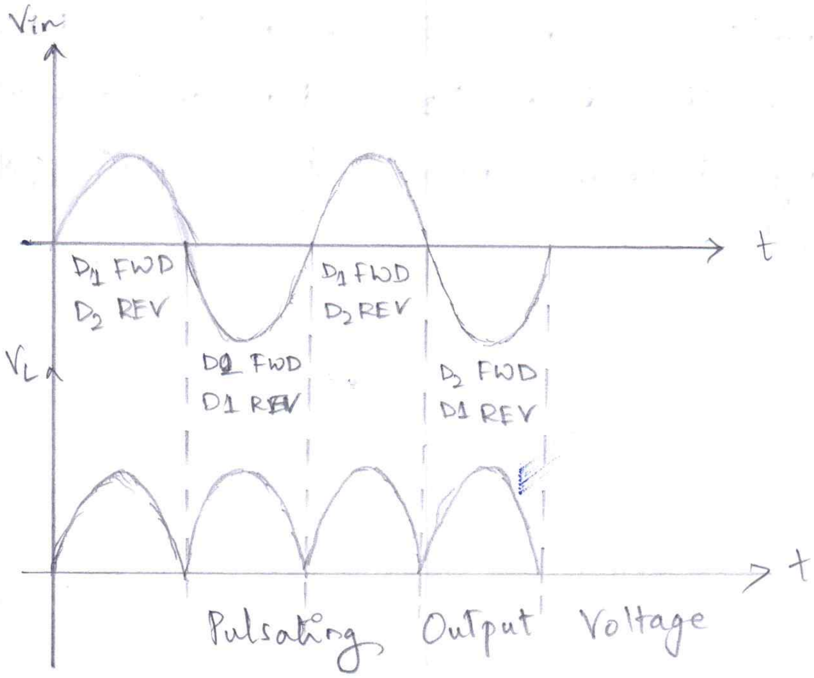
b). Bridge Rectifier.

a). Biphase fullwave rectifier :-

It is a type of full wave rectifier constructed using two diodes & a centre tap transformer. The following is the circuit of the bi-phase full wave rectifier.



During the positive half cycle, for the segment AB, end A is positive & end B is negative & for the segment BC, end B is positive & end C is positive. Hence the diode D_2 is forward biased while the diode D_1 is reverse biased. The following diagram shows the current path during the positive half cycle.



b) Bridge Rectifier :-

It is a type of full wave rectifier constructed using four diodes connected in the form of the bridge. The following is the circuit of Bridge Rectifier Circuit.

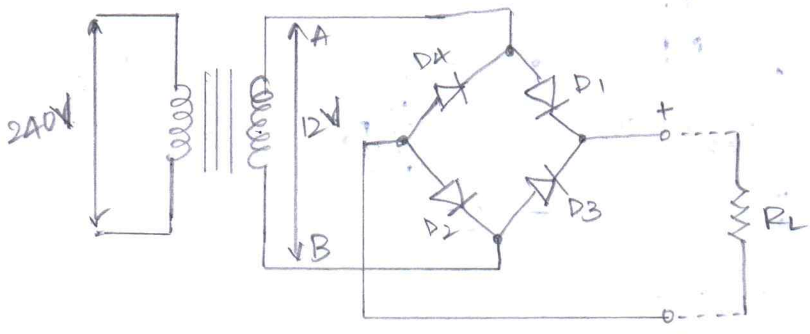
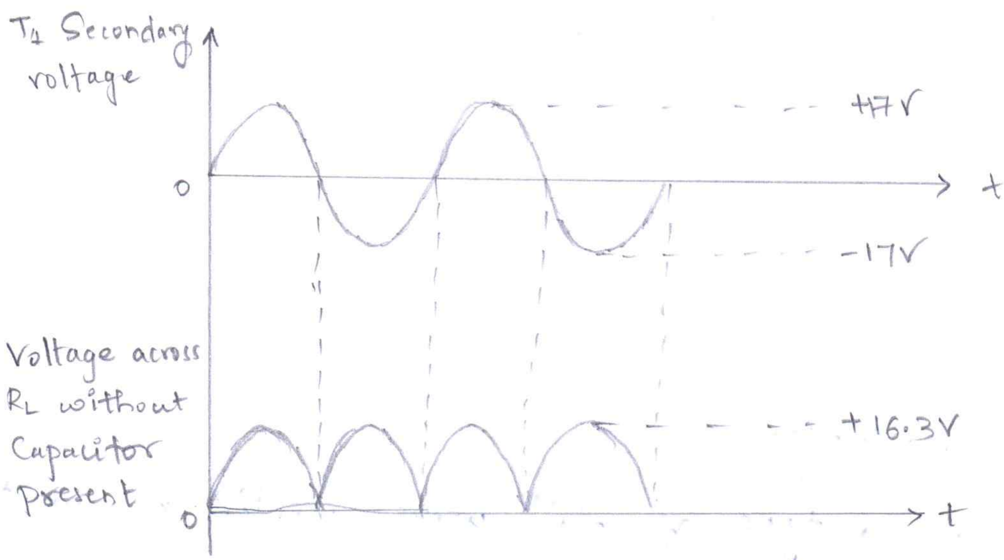


Fig: Bridge Rectifier Circuit.

During the positive half cycle, end A is positive & end B is negative. Hence the diodes D_1, D_2 are forward biased while the diodes D_3 & D_4 are reverse biased. The following diagram shows the current path during the positive half cycle.

During the negative half cycle, end A is negative & end B is positive & for the segment BC, end B is negative & end C is positive. Hence the diode D_3 & D_4 are forward biased while the diode D_2 & D_1 are reverse biased. The following diagram shows the current path during the positive half cycle.



2a. List & describe the ~~main~~ types of amplifiers.

Ans AC coupled Amplifier :-

Stages are coupled together in such a way that dc levels are isolated, & only the AC components of a signal are transferred from stage to stage.

DC (Direct) coupled Amplifier :-

Stages are coupled together in such a way that stages are not isolated to dc potentials. Both ac & dc signal components are transferred from st

Large Signal Amplifiers :-

Designed to cater for 1V - 100V or more.

Small signal amplifiers :-

Designed to cater for low-level signals (normally less than 1V & often much smaller). Specially designed to combat the effects of noise.

Audio frequency amplifiers :-

Operate in the band of frequencies that is normally associated with audio signals (ex. 20Hz to 20kHz).

Radio Frequency Amplifiers :-

Operate in the band of frequencies that is normaly associated with radio (100kHz - 1GHz).

Low Noise Amplifiers :-

Designed so that they contribute negligible noise to the signal being amplified. Designed for use with very small levels (usually less than 10mV or so).

2b. With a block diagram, explain the working of voltage doubler & voltage tripler.

Ans: Voltage doubler :-

It is a type of voltage multiplier circuit in which the output voltage is double the input voltage.

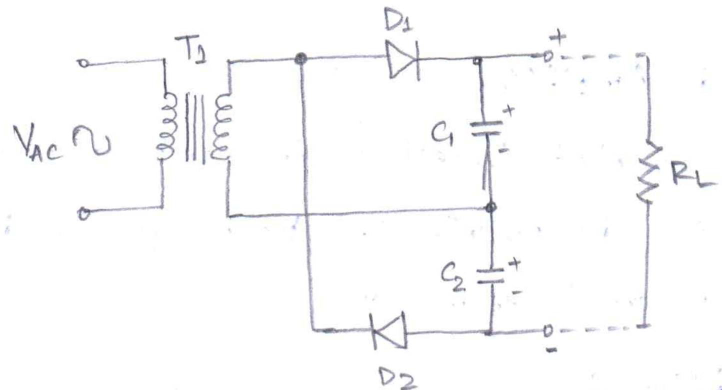


Fig.: Circuit diagram of a Voltage Doubler Circuit

During the positive half cycle the upper end of the transformer secondary is positive & the lower end is negative. Hence the diode D_1 is forward biased while the diode D_2 is reverse biased. ~~The current flows in the circuit as~~

During the negative half cycle the upper end of the transformer secondary is negative & the lower end is positive. Hence the diode D_1 is reverse biased while the diode D_2 is forward biased. ~~The~~

Hence, C_1 will charge to positive peak of secondary & C_2 will charge to negative peak of secondary voltage.

Since the output is taken from C_1 & C_2 connected in series the resulting output voltage is twice that produced by one diode alone.

Voltage Tripler :-

It is a type of voltage multiplier circuit in which the output voltage is double the input voltage.

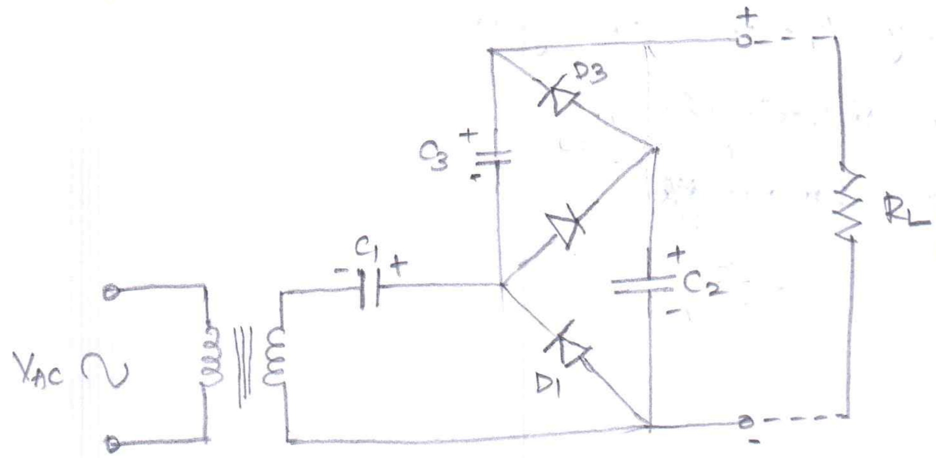


Fig: Circuit diagram of Voltage Tripler.

In the above circuit C_1 charges to the positive peak secondary voltage, while C_2 & C_3 charge to twice the positive peak secondary voltage. The result is that the output voltage is the sum of the voltage across C_1 & C_3 which is three times the voltage that would be produced by a single diode. The ladder arrangement shown above can be easily extended to provide even higher voltages but the efficiency of the circuit becomes increasingly impaired & high-order voltage multipliers of this type are only suitable for providing relatively small currents.

2c. Mention the advantage of negative feedback in amplifier circuit with relevant equations & diagram. Explain the concept of negative feedback.

Ans: Negative feedback refers to the case when the output is fedback to the input in such a way that it subtracts from the input & reduces the overall gain of the circuit.

Advantages of negative feedback

a). Precisely control the gain

b). Reduce distortion

c). Improve bandwidth

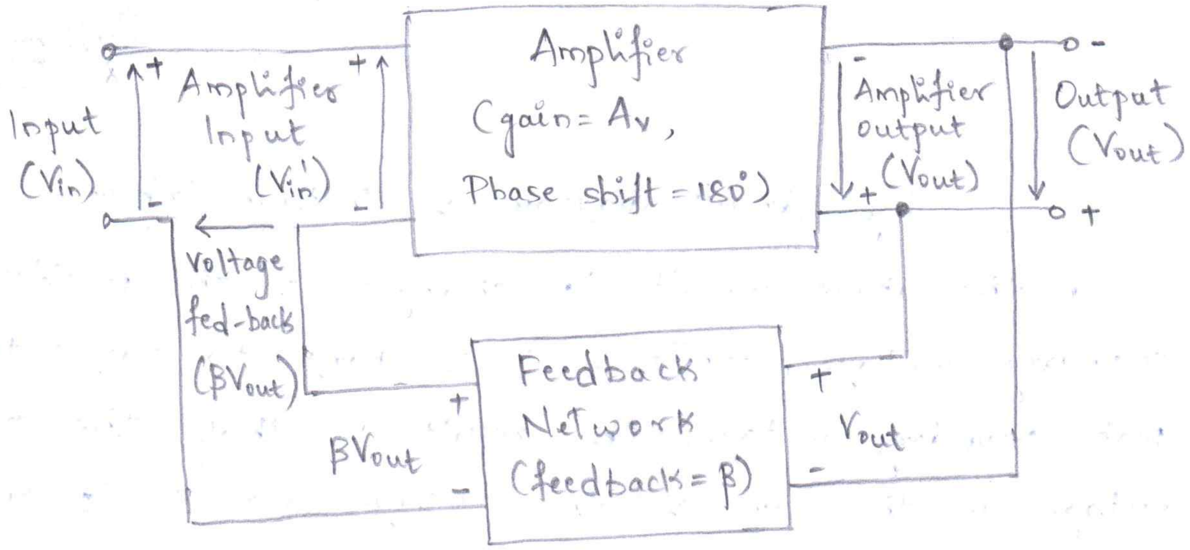


Fig.: An amplifier circuit with negative feedback, with the feedback factor equal to β.

Applying KVL,

$$V_{in} = V_{in}' + \beta V_{out} \longrightarrow (1)$$

$$V_{in}' = V_{in} - \beta V_{out} \longrightarrow (2)$$

where,

$$V_{out} = A_v \times V_{in} \longrightarrow (3)$$

Gain is defined as the ratio of output to input.

$$\text{Gain, } G = \frac{V_{out}}{V_{in}} = \frac{A_v V_{in}}{V_{in}' + \beta V_{out}} = \frac{A_v V_{in}'}{V_{in}' + \beta (A_v V_{in}')}$$

$$\therefore \boxed{G = \frac{A_v}{1 + \beta A_v}}$$

Hence overall gain with negative feedback is less than the gain without feedback.

3a. List & explain the conditions to obtain sustained oscillation. Determine the frequency of oscillations of a 3 stage ladder network in which C = 10nF & R = 10KΩ

Ans: The conditions for sustained oscillations are–

a). The feedback must be positive (zero degree phase shift), i.e. the signal fed back must arrive back in-phase with the signal at the input.

The amplifier provides 180° phase shift, while the feedback network provides another 180° phase shift. Hence the overall phase shift is 0° or 360°.

b). The overall loop voltage gain must be greater than 1, i.e. the amplifier's gain must be sufficient to overcome the losses associated with any frequency selective feed-back network.

Given ; C = 10nF, R = 10KΩ , f = ?

$$f = \frac{1}{2\pi \times \sqrt{6}\, CR} = \frac{1}{2\pi\sqrt{6} \times (10 \times 10^{-9}) * 10 * 10^{3})} = 244.948 Hz$$

3b. With circuit diagram & waveform show how operational amplifier can work as a comparator & voltage follower.

Ans: Comparator :–

A comparator is an electronic circuit, which compare the two inputs that are applied to it & produces the result of comparision as output.

The output value of the comparator indicates which of the input is greater or lesser.

P.T.O

Types of comparator :-

a). Inverting comparator

b). Non-inverting comparator

Inverting comparator :-

It is an opamp based comparator, for which a reference voltage is applied to its noninverting terminal & the input voltage is applied to its inverting terminal.

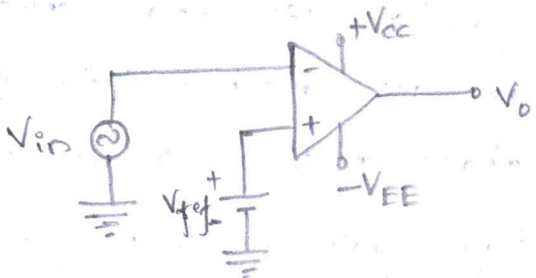


Fig : Circuit diagram of Inverting (Opamp) Comparator

If $V_{in} > V_{ref}$ then, $V_o = -V_{sat}$ &

if $V_{in} < V_{ref}$ then, $V_o = +V_{sat}$

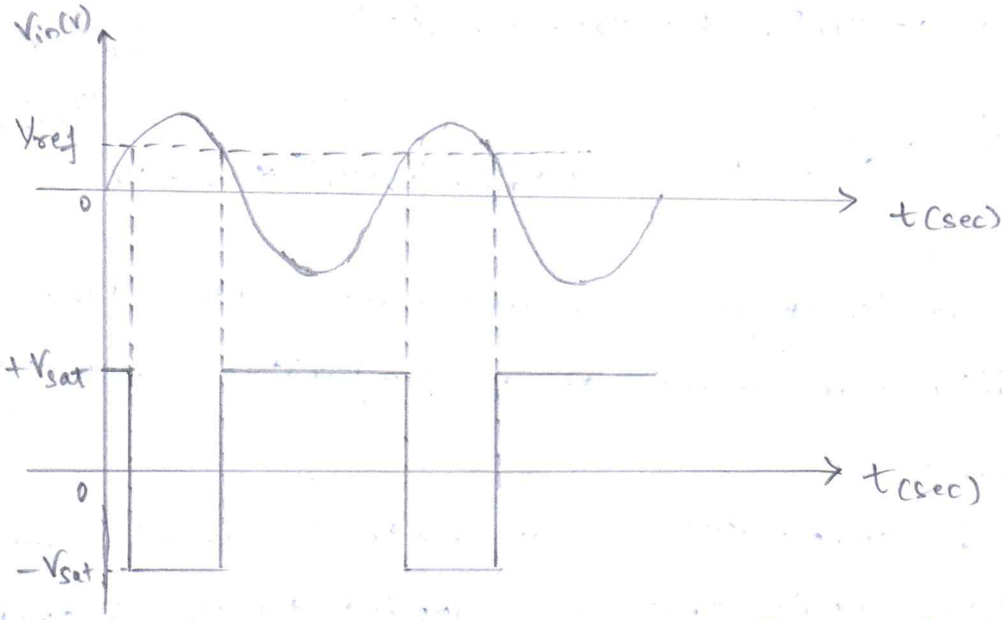


Fig : Wave forms of Inverting Comparator

Non-Inverting Comparator :-

Here the reference voltage is applied to opamp's inverting terminal & the input voltage is applied to non-inverting terminal.

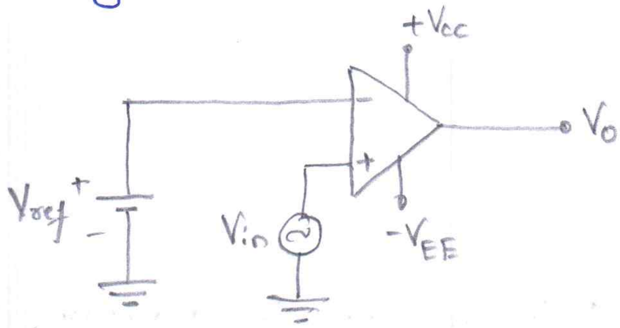


Fig: Circuit diagram of Non-inverting Comparator.

If $V_{in} > V_{ref}$ then, $V_o = +V_{sat}$ &

if $V_{in} < V_{ref}$ then, $V_o = -V_{sat}$

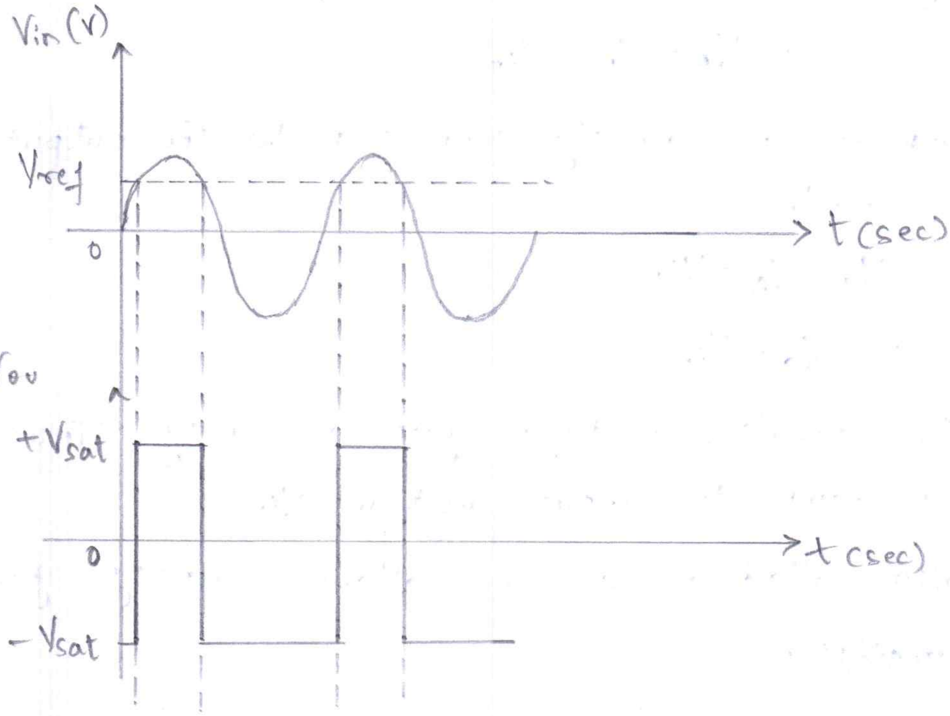


Fig.: Input & Output Waveforms of Non-inverting Comparator

P.T.O

Voltage Follower :-

A circuit in which output voltage follower the input voltage is called voltage follower.

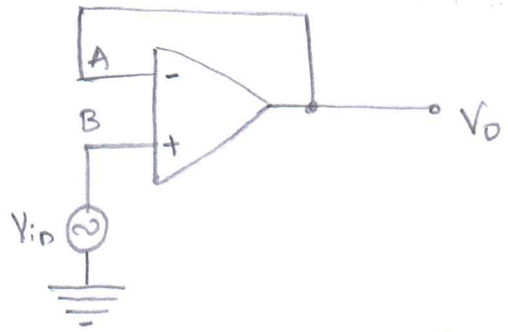


Fig : Voltage Follower circuit diagram.

In the above circuit, the node B is at potential V_{in}. The node A is also at the same potential as B i.e. V_{in} according to concept of virtual ground.

$$\therefore V_A = V_B = V_{in}$$

Now node A is directly connected to the output. Hence we can write,

$$V_o = V_A = V_{in}$$

$$\therefore V_o = V_{in}$$

For this circuit, voltage gain is unity. Thus output voltage is equal to input voltage V_{in}.

It is also called as source follower, unity gain amplifier, buffer amplifier.

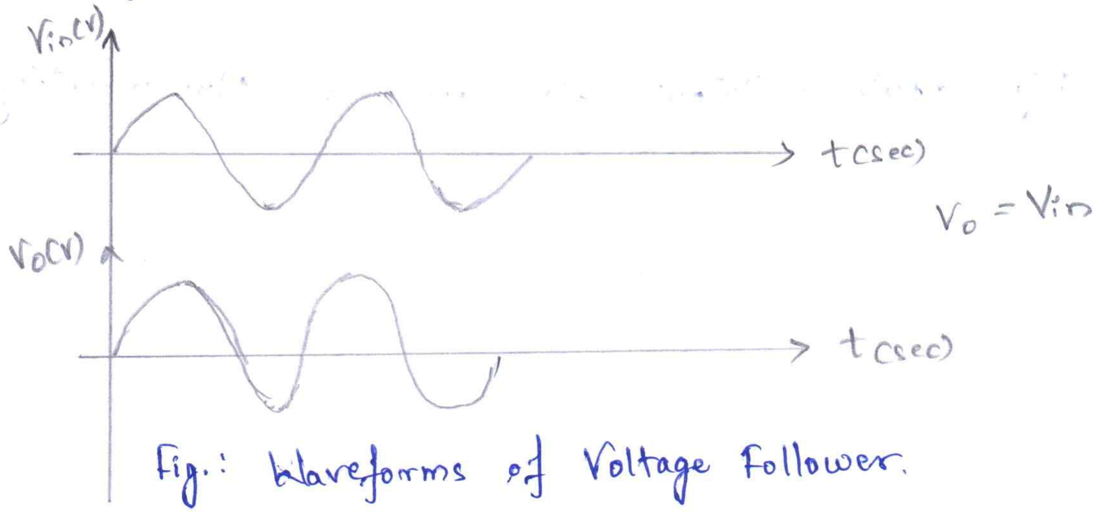


Fig.: Waveforms of Voltage Follower.

4a. With neat circuit diagram explain the working of Wein Bridge oscillator?

Ans: Wein bridge oscillator is an RC oscillator & is used to generate sinusoidal oscillations in the audio frequency range.

The name Wein Bridge is due to the fact that, the network consists of four arms connected in bridge fashion as shown in below figure.

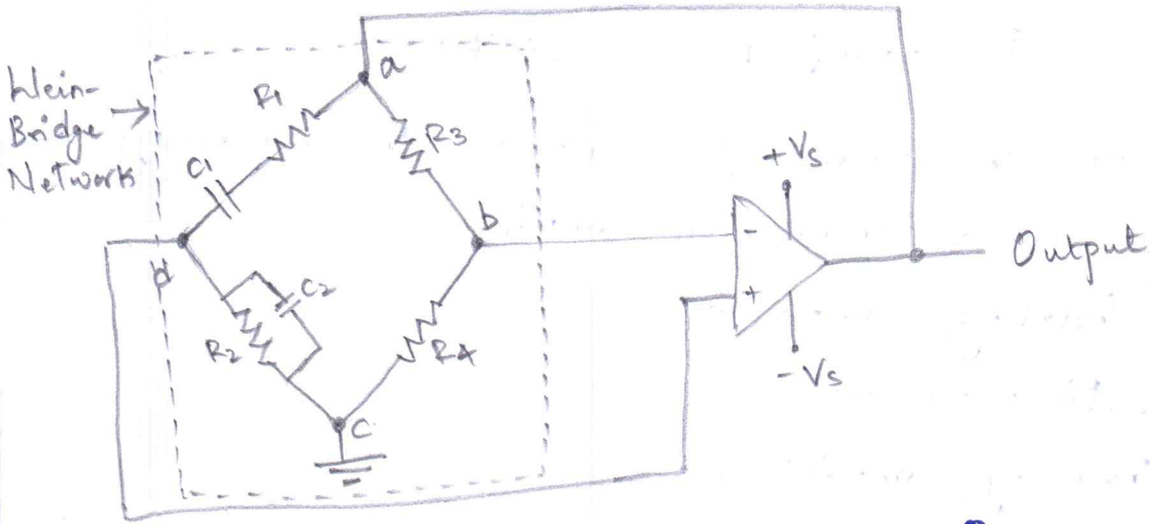


Fig: Wein-Bridge Oscillator Using an Op-amp

- The input signal is applied to b & d while the output is taken from a & c.
- At one particular frequency the phase shift produced by the network will be exactly zero. (i.e. the input & output signals will be in-phase).
- If we connect the networks to an amplifier producing 0° phase shift which has sufficient gain to overcome the losses of the Wein bridge, oscillation will result.

The minimum amplifier gain required to sustain oscillation is given by: $A_V = 1 + \frac{C_1}{C_2} + \frac{R_2}{R_1}$

- When $C_1 = C_2$ & $R_1 = R_2$; the frequency at which the phase shift will be zero is given by:

$$f = \frac{1}{2\pi \times \sqrt{C_1 C_2 R_1 R_2}}$$

- When $R_1 = R_2 = R$ & $C_1 = C_2 = C$, the frequency at which the phase shift will be zero is given by

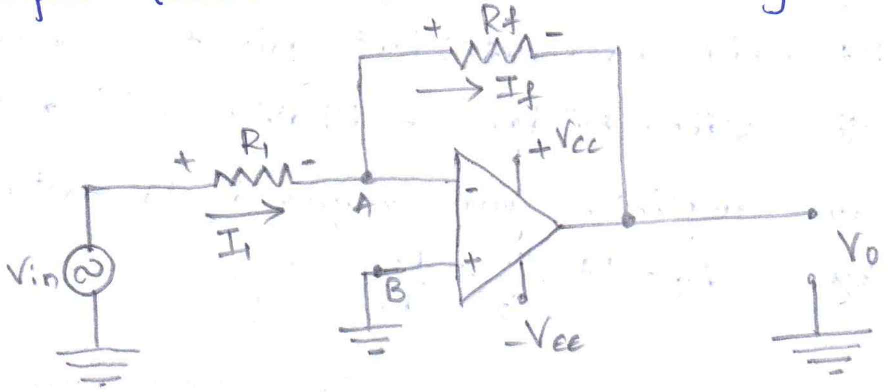
$$f = \frac{1}{2\pi \times \sqrt{C^2 R^2}} = \frac{1}{2\pi CR}$$

4b. Sketch the circuit for each of the following based on the use of operational amplifier
i) Inverting amplifier
ii) Differentiator

Ans: i) Inverting amplifier :-

In an inverting amplifier as the name implies, the output of the amplifier is inverted w.r.t the input signal, i.e. the output signal has 180° phase shift as compared to input signal.

In an inverting amplifier, the input is applied to the inverting terminal while the non-inverting input terminal is connected to ground.



Let Vin be the input voltage & I_f be the current flowing through R_1.

Since input resistance of the opamp is very high, no current flows into the opamp & the entire current flows into the feedback resistance.

Current flowing through $R_1 = I = \frac{V_{in} - V_A}{R_1} \rightarrow (1)$

Current flowing through $R_f = I = \frac{V_A - V_o}{R_f} \rightarrow (2)$

Since node B is grounded, node A is also equal to ground potential.

$$\therefore V_A = 0$$

Equating (1) & (2), we get

$$\frac{V_{in} - V_A}{R_1} = \frac{V_A - V_o}{R_f}$$

$$\frac{V_{in}}{R_1} = -\frac{V_o}{R_f}$$

$$\therefore \frac{V_o}{V_{in}} = -\frac{R_f}{R_1}$$

$\therefore$ Voltage gain, $A_{VF} = \frac{V_o}{V_{in}} = -\frac{R_f}{R_1}$

Here, (R_f/R_1) represents the gain of the amplifier, while the negative sign indicates that the output is inverted w.r.t the input. Hence it is called as inverting amplifier.

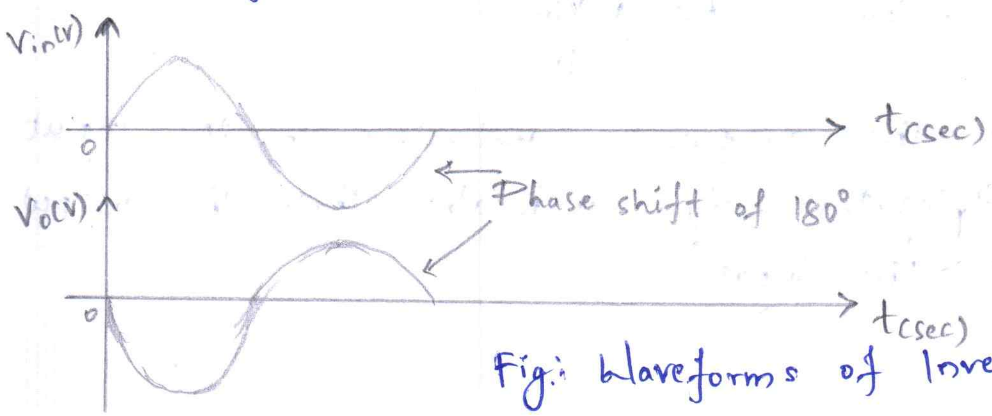
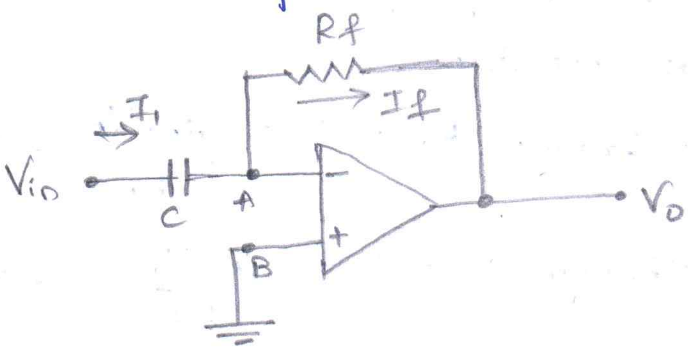


Fig: Waveforms of Inverting Ampr.

ii) Differentiator :-

It produces an output that is equal to the rate of change of input. The faster the input changes, greater will be the output.



Since B is grounded, point A is also at zero potential i.e. $V_A = 0$.

As current through opamp is zero, the entire current I_1 flows through Rf.

$$\therefore I_1 = C\frac{d(V_{in} - V_A)}{dt}$$

Since $V_A = 0$, $\quad I_1 = C\frac{d(V_{in})}{dt} \longrightarrow (1)$

If, $\frac{V_A - V_o}{R_f} = \frac{-V_o}{R_f} \longrightarrow (2)$

Equating (1) & (2)

$$C\frac{d(V_{in})}{dt} = -\frac{V_o}{R_f}$$

$$\therefore V_o = -CR_f\frac{d(V_{in})}{dt}$$

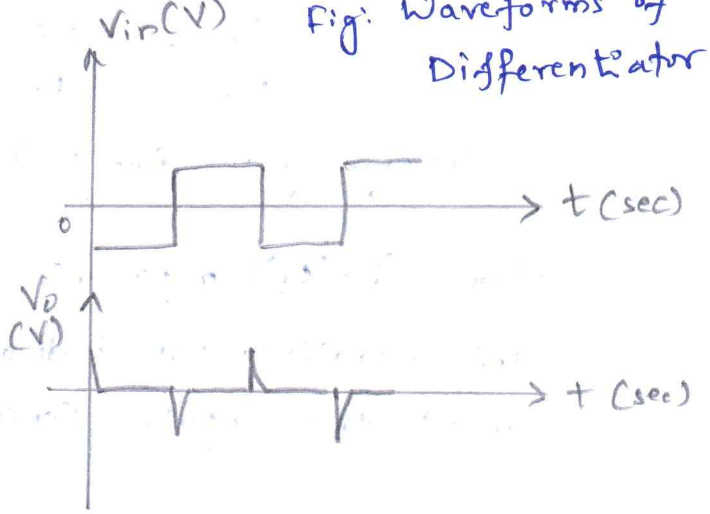


Fig: Waveforms of Differentiator

Hence the output is derivative of the input signal & the negative sign indicates that the output is inverted w.r.t the input.

5a. Explain with circuit diagram full adder.

Ans: Full Adder :-

Half adder does not takes the carry-in value into account. Full adder is developed to overcome this drawbacks of Half adder circuit. It can add two one-bit numbers A & B, along with carry Cin.

The full adder is a three input & two output combinational circuit.

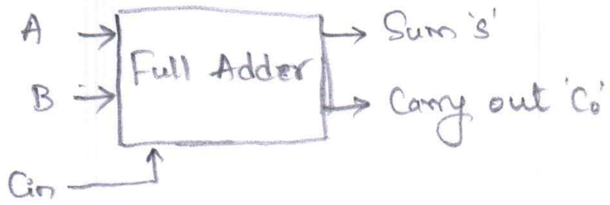


Fig.: Block diagram

Inputs			Output	
A	B	Cin	S	Co
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Truth table.

From truth table,

The logic expression for sum is given by

$S = \bar{A}\bar{B}C_{in} + \bar{A}B\bar{C}_{in} + A\bar{B}\bar{C}_{in} + ABC_{in}$

$S = \bar{A}(\bar{B}C_{in} + B\bar{C}_{in}) + A(\bar{B}\bar{C}_{in} + BC_{in})$ $\quad \because A \oplus B = A\bar{B} + \bar{A}B$

$S = \bar{A}(B \oplus C_{in}) + A(\overline{B \oplus C_{in}})$ $\quad A \odot B = \bar{A}\bar{B} + AB$

$\quad A \odot B = \overline{A \oplus B}$

$S = A \oplus B \oplus C_{in}$

The logic expression for carry out is given by

$C_o = \bar{A}BC_{in} + A\bar{B}C_{in} + AB\bar{C}_{in} + ABC_{in}$

$C_o = (\bar{A}B + A\bar{B})C_{in} + AB(\bar{C}_{in} + C_{in})$

$C_o = \bar{A}BC_{in} + ABC_{in} + AB$

$= \bar{A}BC_{in} + A(BC_{in} + B)$ $\quad \because A + \bar{A}B = A + B$

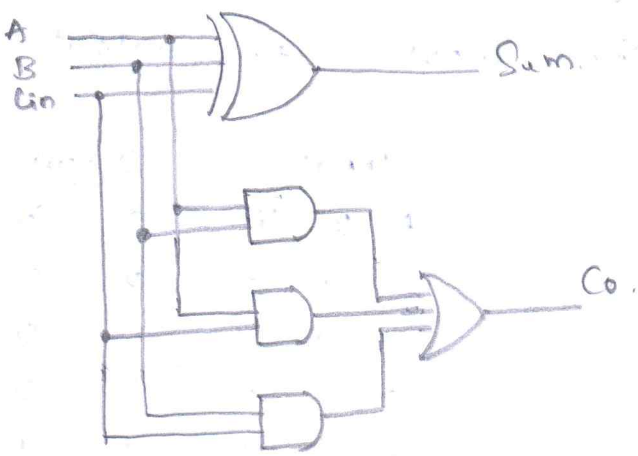
$C_o = \bar{A}BC_{in} + A(B+C_{in})$

$= \bar{A}BC_{in} + AB + AC_{in}$

$= B(\bar{A}C_{in} + A) + AC_{in}$

$= B(A + C_{in}) + AC_{in}$

$\therefore C_o = AB + BC_{in} + AC_{in}$



5b. Given two binary numbers $x = 1010100$ & $Y = 1000011$ perform the subtraction

i). $x - Y$ & ii) $Y - X$ using 2's complement.

Ans: $X = 1010100$ & $Y = 1000011$

i). $x - Y$

1's complement of Y = 0111100
+ 1
2's complement of Y = 0111101

$\therefore$ x = 1010100
+ 2's Y = 0111101
CY=1 0010001

discard carry

Carry out of MSB $\therefore$ result is positive

$\therefore (X - Y)_2 = (0010001)_2 = (17)_{10}$

ii). Y − X

1's complement of x = 0101011
$\quad\quad\quad\quad\quad\quad\quad\quad\quad$ + 1

2's complement of x = 0101100

∴ Y = 1000011
$\quad$ + 2's X = 0101100

Result = 1101111

No carry out of MSB ∴ result is negative

Take 2's complement of result:-

1's complement of result = 0010000
$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad$ + 1

2's complement of result = 0010001 = $(-17)_{10}$

∴ $(Y-X)_2 = (0010001)_2 = (-17)_{10}$

5c. Convert i). Decimal 225 to binary

ii). Binary 1101011 to octal

iii). Octal 623 to decimal

iv). Hexadecimal 2AC5 to decimal.

Ans: i). $(225)_{10} = (?)_2$

2	225	
2	112	− 1
2	56	− 0
2	28	− 0
2	14	− 0
2	7	− 0
2	3	− 1
2	1	− 1

↑ LSB
MSB

∴ $(225)_{10} = (11100001)_2$

ii). $(1101011)_2 = (?)_8$

Add leading zero → 011 010 111
$\quad\quad\quad\quad\quad\quad\quad$ 3 $\quad$ 2 $\quad$ 7

∴ $(1101011)_2 = (327)_8$

iii). $(623)_8 = (?)_{10}$

$= 6\times8^2 + 2\times8^1 + 3\times8^0$

$= 6\times64 + 2\times8 + 3\times1$

$= 403$

∴ $(623)_8 = (403)_{10}$

iv) $(2AC5)_{16} = (?)_{10}$

$= 2\times16^3 + A\times16^2 + C\times16^1 + 5\times16^0$

$= 2\times16^3 + 10\times16^2 + 12\times16 + 5\times1$

$= 8192 + 2560 + 192 + 5$

$= 10949$

$\therefore (2AC5)_{16} = (10949)_{10}$

6a. Express the boolean function $F1 = A+\bar{B}C$ in a sum of minterms form & $F2 = xy + \bar{x}z$ in a product of maxterms form.

Ans: $F_1 = A+\bar{B}C$

$= A(B+\bar{B}) + \bar{B}C(A+A')$

$= AB + AB' + AB'C + A'B'C$

$= AB(C+C') + AB'(C+C') + AB'C + A'B'C$

$= ABC + ABC' + \underline{AB'C} + AB'C' + \underline{AB'C} + A'B'C.$

$= A'B'C + AB'C' + AB'C + ABC' + ABC$

$\quad 1 \quad 4 \quad 5 \quad 6 \quad 7$

$\therefore F_1 = \Sigma m(1,4,5,6,7)$

$F_2 = xy + x'z$

$= (xy+x')(xy+z) \qquad \because A+BC = (A+B)(A+C)$

$= (\bar{x}+x)(\bar{x}+y)(x+z)(y+z)$

$= (\bar{x}+y)(x+z)(y+z)$

$= (\bar{x}+y+z\bar{z})(x+z+y\bar{y})(y+z+x\bar{x})$

$= (\bar{x}+y+z)(\bar{x}+y+\bar{z})(x+z+y)(x+z+\bar{y})(x+y+z)(\bar{x}+y+z)$

$= (\bar{x}+y+z)(\bar{x}+y+\bar{z})(x+z+y)(x+z+\bar{y})$

$\quad 100 \quad 101 \quad 000 \quad 001$

$= \pi M(0,2,4,5)$

6b. Design full adder using two half address & one OR gate

Ans

Inputs			Output	
A	B	Cin	S	Co
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

From, truth table, logic expression for sum is given by

$S = A \oplus B \oplus Cin$

$C_o = AB + BCin + ACin = (A \oplus B) Cin + AB.$

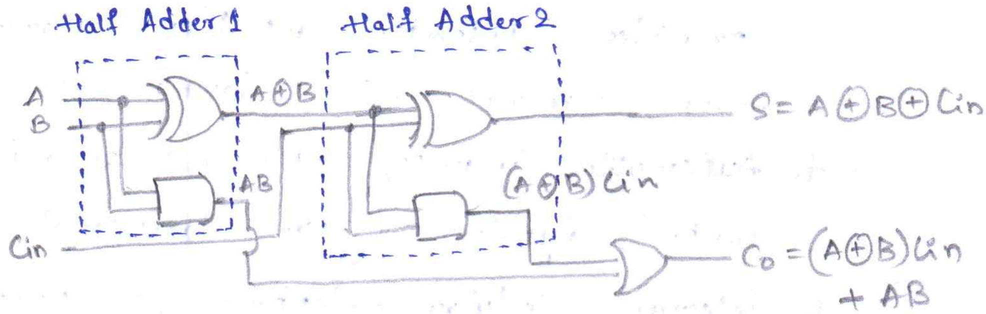


Fig: Full Adder using two half adder & one OR gate.

7a. Compare embedded system & general-purpose computing system & also provide major application areas of embedded system

Ans:

General Purpose Computing System	Embedded System
Contains a General Purpose Operating System (GPOS)	May or may not contain an operating system for functioning
Applications are alterable (programmable) by the user	The firmware of the embedded system is pre-programmed & it is non-alterable by the user.
Performance is the key deciding factor in the selection of the system. Always faster is better.	Application specific requirements are the key deciding factors.
Less/not at all tailored towards reduced operating power requirements, options for different levels of power management.	Highly tailored to take advantage of the power saving modes supported by the hardware & the operating system.
Response requirements are not time-critical.	For certain category of embedded systems like mission critical systems, the response time requirement is highly critical.

Major application areas of embedded system are :-

1. Consumer electronics : Camcorders, cameras, etc
2. Household appliances : Television, DVD players, washing machine, fridge, microwave oven, etc
3. Home automation & security systems : Air conditioners, sprinklers, intruder detection alarms, closed circuit television cameras, fire alarms, etc
4. Automotive industry : Anti-lock breaking systems (ABS), engine control, ignition systems, automatic navigation systems, etc.
5. Telecom : Cellular telephones, telephone switches, handset multimedia applications, etc.
6. Computer peripherals : Printers, scanners, fax machines, etc.
7. Healthcare : Different kinds of scanners, EEG, ECG machines etc.

7b. Bring out the difference between RISC & CISC, microprocessor & microcontroller.

Ans.

RISC	CISC
Lesser number of instructions.	Greater number of instructions.
Instruction pipelining & increased execution speed	Generally no instruction pipe-lining feature
Orthogonal instructions set	Non-orthogonal instruction set.
Operations are performed on registers only, the only memory operations are load & store.	Operations are performed on registers or memory depending on the instruction.
A large numbers of registers are available	Limited number of general purpose registers.
Programmer needs to write more code to execute a task since instructions are simpler	Instructions are like macros in C language. With a single instruction desired functionality can be achieved.

RISC	CISC
Single, fixed length instⁿ.	Variable length instructions.
Less silicon usage & pin count	More silicon usage since more additional decoder logic is required to implement the complex instruction decoding.
With Harvard Architecture	Can be Harvard or Von-Neu -mann Architecture

Microprocessor	Microcontroller.
• A silicon chip representing a central processing unit (CPU), which is capable of performing arithmetic as well as logical operations according to a predefined set of instructions.	• Is a highly integrated chip that contains a CPU, RAM, special & general purpose register arrays, on chip ROM/FLASH memory for programs storage, timer & interrupt control units & dedicated I/O ports.
• It is dependent unit. It requires the combination of other chips like timers, prog -ram & data memory chips, interrupt controllers etc., for functioning	• It is a self contained unit & it doesn't require external interrupt controllers, timer etc, for its functioning
• General purpose in design & operation	• Mostly application-oriented or domain-specific
• Doesn't contain built-in I/O ports	• Contain multiple built-in I/O ports.
• Targeted for high-end market where performance is impor -tant.	• Targeted for embedded market where performance is not so critical.
• Limited power saving optim	• Includes lot of power saving features.

8a Draw the basic block diagram of instrumentation & control system. Also explain the feedback-based control system.

Ans:

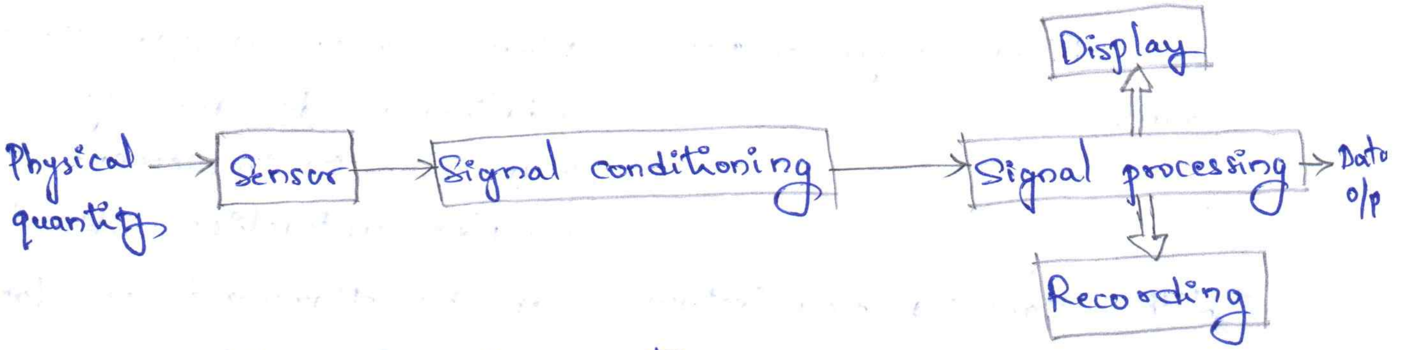


Fig. a: Instrumentation system.

An instrumentation is a device that measures or manipulates or process physical variables such as temperature, pressure etc.

fig.a, shows the arrangement of an instrumentation system. The physical quantity to be measured acts upon a sensor that produces an electrical output signal. The output produced by the sensor may be small or may suffer from the presence of noise further signal conditioning will be required before the signal will be in an acceptable form for signal processing, display & recording. The signal processing may use digital rather than analogue signals an additional stage of A2D conversion is required.

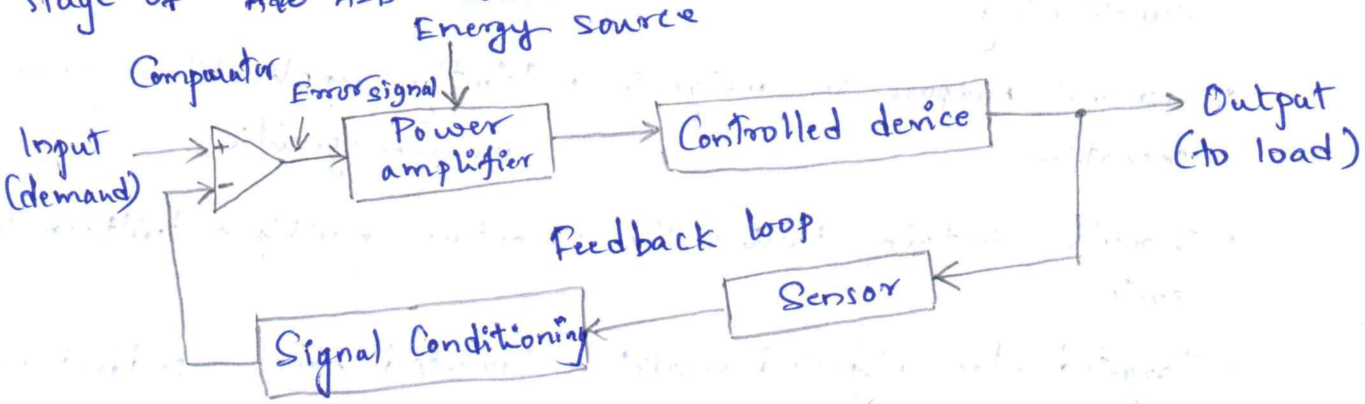


Fig. b: A control system

Fig.b, shows the arrangement of a control system. This uses negative feedback in order to regulate & stabilize the output.

It thus becomes possible to set the input or demand & leave the system to regulate itself by comparing it with a signal derived from the output.

A comparator is used to sense the difference in these two signals & where any discrepancy is detected the input to the power amplifier is adjusted accordingly. This signal is referred to as an error signal. The controlled device can take many forms like, dc motor, heater etc.

8b. With a neat diagram explain the working of LED & 7 segment display

Ans: LED :-

- Light Emitting Diode (LED) is an important output device for visual indication in any embedded system.
- It is an p-n junction diode & it contains an anode & a cathode
- For proper functioning of the LED, the anode of it should be connected to +ve terminal of the supply voltage & cathode to the -ve terminal of the supply voltage

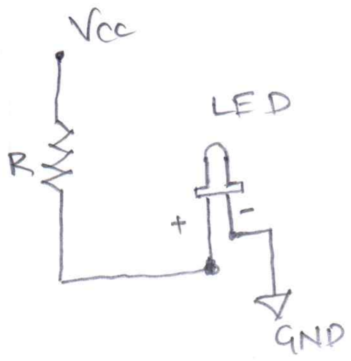


Fig. : LED Interfacing

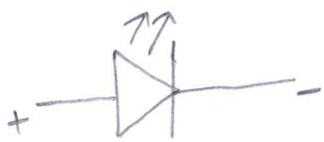


Fig. : LED

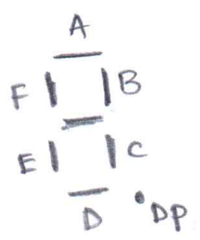
7-Segment LED Display:-

The 7-segment LED display is an output device for displaying alpha numeric characters.

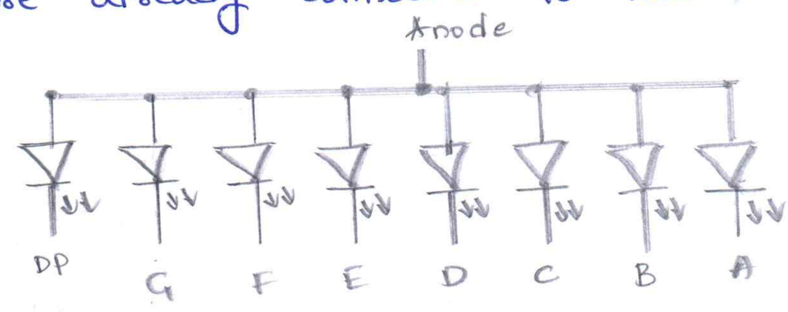
- It contains 8-LEDs segments arranged in a special form.
- Out of the 8-LED segments, 7 are used for display-ing alpha numeric characters & 1 is used for representing decimal point.
- The LED segments are named A to G & the decimal point LED segment is named as DP.
- The LED segments A to G & DP should be lit accord-ingly to display numbers & characters.
- The 7-segment LED displays are available in two different configurations, viz; Common anode & Common cathode.

Common anode configuration:-

- Here, the anodes of the 8-segments are connected commonly to ground.
- To display '0', the inputs a, b, c, d, e, f should be made "low" to forward bias the corresponding LEDs, as the anodes are already connected to Vcc.



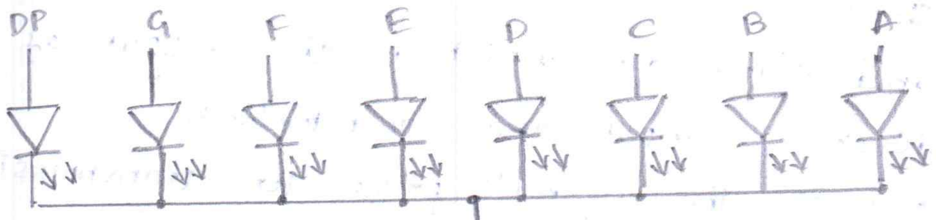
7-Segment Display



Common Anode LED Display Configuration

Common cathode configuration:-

- Here, the 8LEDs segments share a common cathode line, connected to ground.
- To display the number '0', LEDs A, B, C, D, E, F should be switched "on" or made "high" & DP should be made "off" or "low" in the 7-segment display.



Common Cathode LED Display Configuration

9a. With a neat diagram explain the basic blocks used in communication system.

Ans:

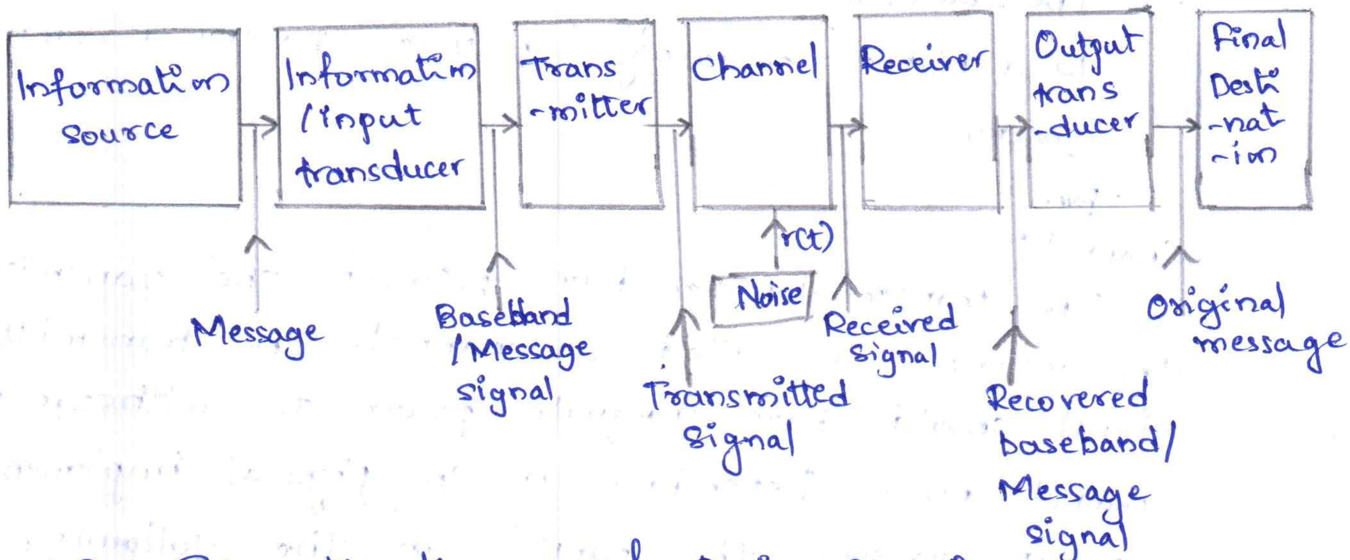


Fig: Schematic diagram of Basic Commⁿ System.

Information source :-

A communication system transmits information from an information source (message) to a destination. Ex- voice, video, music, written text, & e-mail.

Input Transducer :-

It is a device that converts a non-electrical energy into its corresponding electrical called baseband signal s(t).

Ex - Sound : Microphone , Picture : Camera , Text: Keyboard, Temperature / Pressure : Sensor with transducer.

Transmitter :-

- Baseband signal s(t) which is the output of the input transducer is input the transmitter.
- It processes the signal prior to transmission. Nature of processing depends on the type of communication system. Two options are available for processing

i). Baseband signal which lies in low frequency spectrum is translated to the high frequency spectrum - Carrier Communication system.

ii). The baseband signal is transmitted without translating to a higher frequency spectrum - Baseband communication system.

Channel :-

The transmission medium between the transmitter & the receiver is called a channel. The transmitted signal should have adequate power to withstand the channel noise. Depending on the physical implementations, one can classify the channels in the following two groups;

a). Hardwired channels : Ex - Transmission lines, Waveguides & OFC.

b). Soft-wired channels : Ex - Air or Open space & Sea water.

Noise :-

It is an unwanted signal & does not contain any information denoted as n(t). When noise is mixed with the transmitted signal, it rides over it & deteriorates its waveform. This results in alteration of the original signal & wrong information is received. The signal power should be sufficiently increased so that it can withstand the noise.

Receiver :-

It provides original information to the user. The information is altered due to the processing at the transmitter. The signal received by the receiver is r(t). This signal contains both the transmitted signal x(t) & the noise n(t) added to it during transmission. The receiver performs the opposite operation, demodulation which brings signal from high freq^n to low freq^n spectrum. & recovers the original baseband signal s(t).

Output transducer :-

Converts the electrical baseband signal s(t) back to non-electrical original signal & delivered to destination.

9b. Explain ~~briefly~~ the need ~~o~~for modulation & explain briefly the types of modulation used for communication.

Ans: Modulation is the process of varying characteristics such as amplitude, frequency or phase of the carrier signal in accordance with the amplitude of the message signal, that contains information to be transmitted.

Need for modulation :-

1. Height of the antenna is reduced :-

When we transmit a radio signal antenna height must be a multiple of $\lambda/4$ where λ is the wavelength whose value is $\lambda = c/f$.

This means that higher the frequency lesser will be the value of λ that result in the shorter height of antenna which can be practically installed.

Thus modulation reduces the antenna height.

2. Avoid mixing of signals :
3. Increase in the range
4. Multiplexing can be done.
5. Improves quality of reception
6. Bandwidth extension
7. Reduced noise & interference

Types of Modulation :-

Modulation

- Analog carrier
  - Analog data
    - → AM - Carrier amp^{d}
    - → FM - " freq^{n}
    - → PM - " phase
  - Digital data
    - → ASK - Carrier amp^{d}
    - → FSK - " freq^{n}
    - → PSK - " phase
    - → QAM - " amp^{d} & phase
- Digital carrier
  - Analog data
    - → PAM - pulse amp^{d}
    - → PWM - " width
    - → PPM - " position
  - Digital data
    - ↓ PCM coding

Analog modulation schemes :-

1. Amplitude modulation (AM) - here the instantaneous amp^{l} of the carrier signal is varied in accordance with the instantaneous amp^{l} of the analog modulating signal to be transmitted, keeping freq^{n} & the phase of the carrier constant.
2. Frequency modulation (FM) - Process of changing the freq^{n} of the carrier signal in accordance with the instantaneous amp^{l} of the modulating signal while keeping the amp^{l} & phase of the carrier constant.
3. Phase modulation (PM) - Process in which the instantaneous phase of the carrier signal is varied in accordance with the instantaneous amp^{l} of the modulating signal, while keeping amp^{l} & freq^{n} of the carrier constant.

Digital Modulation Schemes :-

1. Amp^{l} Shift Keying (ASK) - Represents digital data as variations in the amp^{l} of a carrier wave.
2. Freq^{n} Shift keying (FSK) - Digital information is transmitted through discrete freq^{n} changes of a carrier signal.
3. Phase Shift Keying (PSK) - Conveys the digital data by changing the phase of the constant freq^{n} carrier.

10a. What are the advantages & disadvantages of digital comm^{n} over analog comm^{n}.

Ans: Advantages of digital comm^{n} over analog comm^{n}:

1. Less sensitive to noise.
2. Digital circuits are easy to design & cheaper than analog

3. It is easier to integrate different services.
4. The transmission scheme can be relatively independent of the source
5. Signal processing functions such as encryption & compression are employed in digital circuits to maintain the secrecy of the information.
6. Digital circuits are less sensitive to physical effects such as vibration & temp^{r}.

Disadvantages of digital communication over analog comm^{n}:

1. Higher bandwidth requirement
2. Require complex equipments.
3. Quantization errors
4. Latency
5. Higher power consumption.

10b. With a neat diagram explain the working of time division multiplexing & freq^{n} division multiplexing?

Ans • Multiplexing is the process that allows transmission of more than one signal on a single channel.

Time Division Multiplexing (TDM):-

- It is a technique used in digital & analog comm^{n} system to transmit multiple signals over a single comm^{n} channel by dividing time into distinct slots.
- Each signal is allocated a specific time slot in which it can transmit its data. These time slots are assigned in a round-robin fashion, & the signals take turns using the channel.

- It is widely used in telephone networks, digital audio & video transmission, & satellite comm^n.

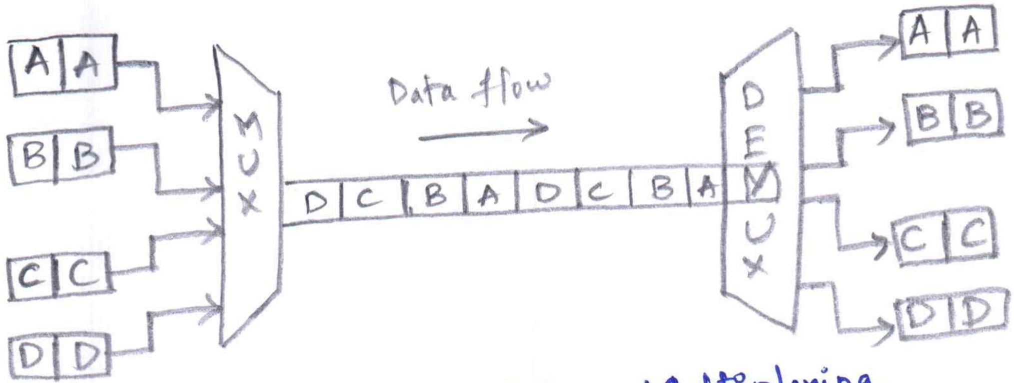


Fig.: Time Division Multiplexing

Frequency Division Multiplexing (FDM):-

- It is a technique used in analog comm^n to transmit multiple signals simultaneously over a single comm^n comm^n channel by dividing the available bandwidth into multiple freq^n bands.
- Each signal is assigned a unique freq^n range (band), & all signals are transmitted at the same time, but at different frequencies.
- To prevent overlapping & interference, guard bands are placed between adjacent freq^n bands.
- It is used in traditional radio & TV broadcasting, cable TV, & early telephone systems.

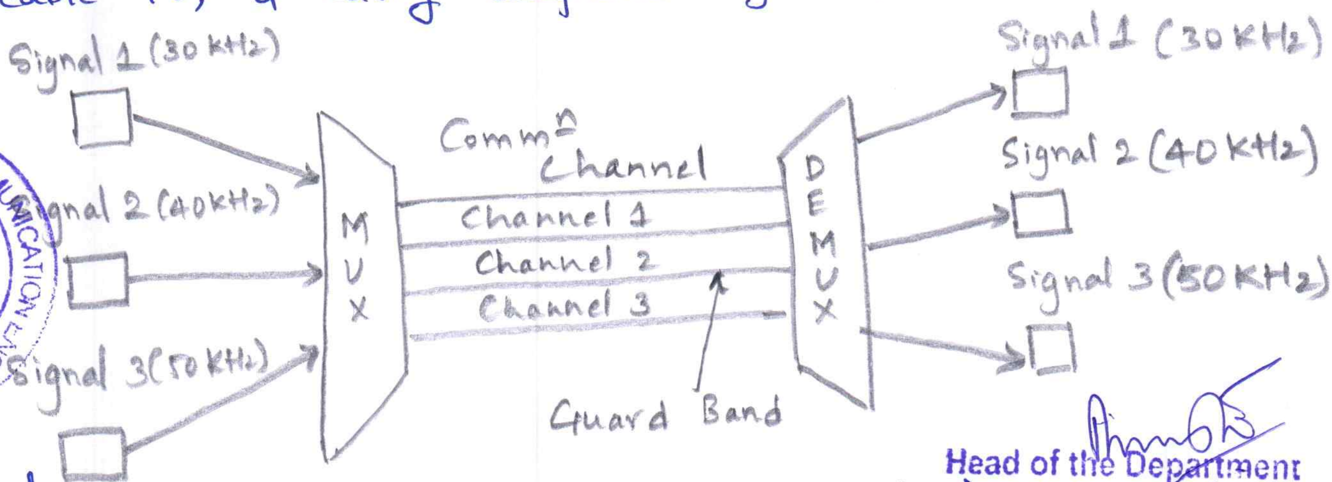


Fig: Frequency Division Multiplexing