Department of Electronics and Communication Engineering

Sub Code/Name: **BEC6L2 -ELECTRONICS SYSTEM DESIGN LAB**

Name : ……………………………………

Reg No : ……………………………………

Branch : ……………………………………

Year & Semester : ……………………………………

LIST OF EXPERIMENTS

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1	Design of high current linear variable DC Power supply	
2	Design of Switched Mode power supply	
3	Design of AC / DC Voltage regulator using SCR.	
4	Design of Programmable Logic controller.	
5	Design of process control timer.	
6	Design of AM / FM transreceiver	
7	Design of wireless data Modems	
8	Design of Instrumentation amplifier and Digital Indicator	
9	PCB layout Design using CAD	
10	Microprocessor based system design.	
11	DSP based system design.	

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Expt.	Date	Name of the Experiment	Marks	Staff SIGN

Ex No:1

Date:

DESIGN OF HIGH CURRENT LINEAR VARIABLE DC POWER SUPPLY

AIM:

To design a high current, low voltage and high voltage linear variable dc regulated power supply and test its line and load regulation.

APPARATUS REQUIRED:

S.NO	APPARATUS	SPECIFICATION	QUANTITY
1.	Transistors	TIP122,2N3055	1 each
2.	Integrated Circuit	LM723	1
3.	Digital Ammeter	(0 – 10) A	1
4.	Digital Voltmeter	(0 – 20) V	1
5.	Variable Power Supply	(0 – 30) V-2A	1
6.	Resistors	300Ω ,430Ω ,1KΩ ,678KΩ ,67 8Ω 1Ω	1 each 2
7.	Capacitors	0.1μ F,100pF	1 each
8.	Rheostat	(0 – 350) Ω	1

THEORY:

A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. Load regulation is the change in output voltage for a given change in load current. Line regulation or input regulation is the degree to which output voltage changes with input (supply) voltage changes - as a ratio of output to input change. Active regulators employ at least one active (amplifying) component such as a transistor or operational amplifier. linear regulator is a voltage regulator based on an active device (such as a bipolar junction transistor, field effect transistor or vacuum tube) operating in its "linear region"

PROCEDURE:

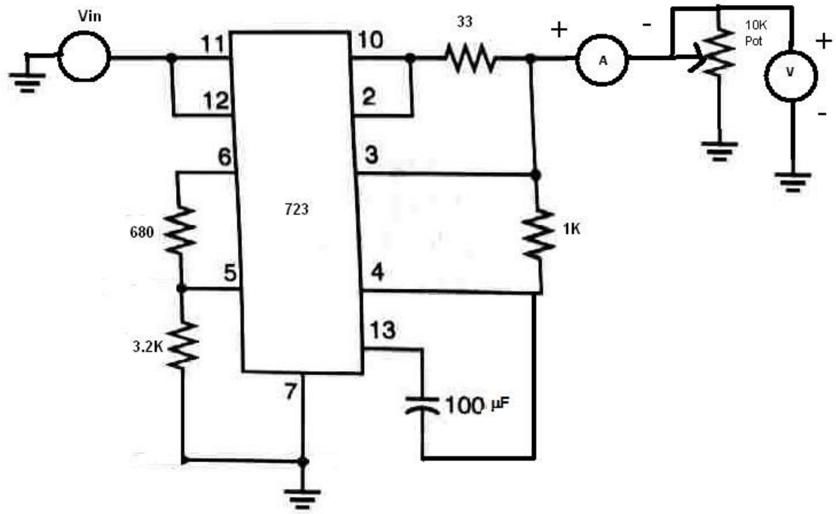
Line Regulation:

- Give the circuit connection as per the circuit diagram
- Set the load Resistance to give load current of 0.25A
- Vary the input voltage from 7V to 18V and note down the corresponding output voltages
- Similarly set the load current (I_L) to 0.5A & 0.9A and make two more sets of measurements.

Load Regulation:

- Set the input voltage to 10V.
- Vary the load resistance in equal steps from 350Ω to 5Ω and note down the corresponding output voltage and load current.
- Similarly set the input voltage (Vin) to 14V & 18V and make two more sets of measurements.

CIRCUIT DIAGRAM:

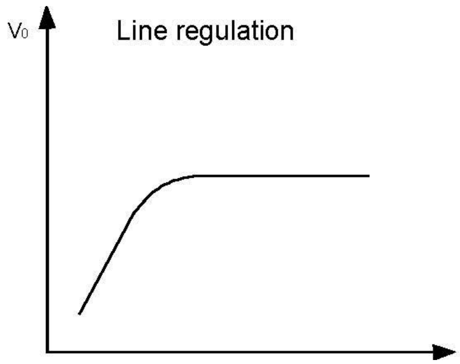


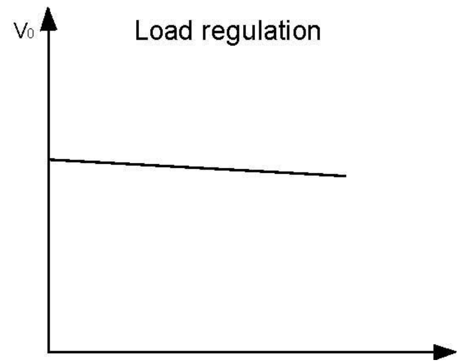
Load Regulation:

S.No:	I/P Voltage (V)	O/P Voltage (V)

Line Regulation:

S.No:	I/P Voltage	
	O/P Current (mA)	O/P Voltage (V)





RESULT:

Thus the line and load regulation of low voltage linear variable dc regulated power supply was designed and tested.

Ex.No.3

Date:

DESIGN OF AC/DC VOLTAGE REGULATOR USING SCR

AIM:

(i)To design, construct and test a AC voltage regulator using SCR. (ii)To design, construct and test a DC voltage regulator using SCR.

APPARATUS REQUIRED:

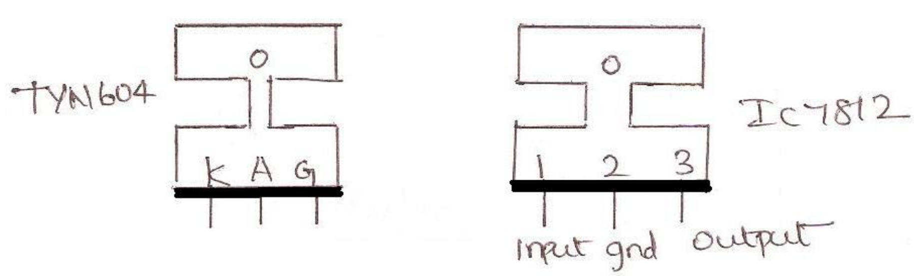
AC VOLTAGE REGULATOR:

S.No	Name of the Apparatus	Range	Quantity
1	Transformer	230V/12V	1
2	SCR	2P4M	2
3	Diode	BY 127	2
4	Resistor	100 k 12 k	2 1
5	Bread Board		1
6	Connecting Wires		As required
7	CRO		1
8	DRB		1

DC VOLTAGE REGULATOR:

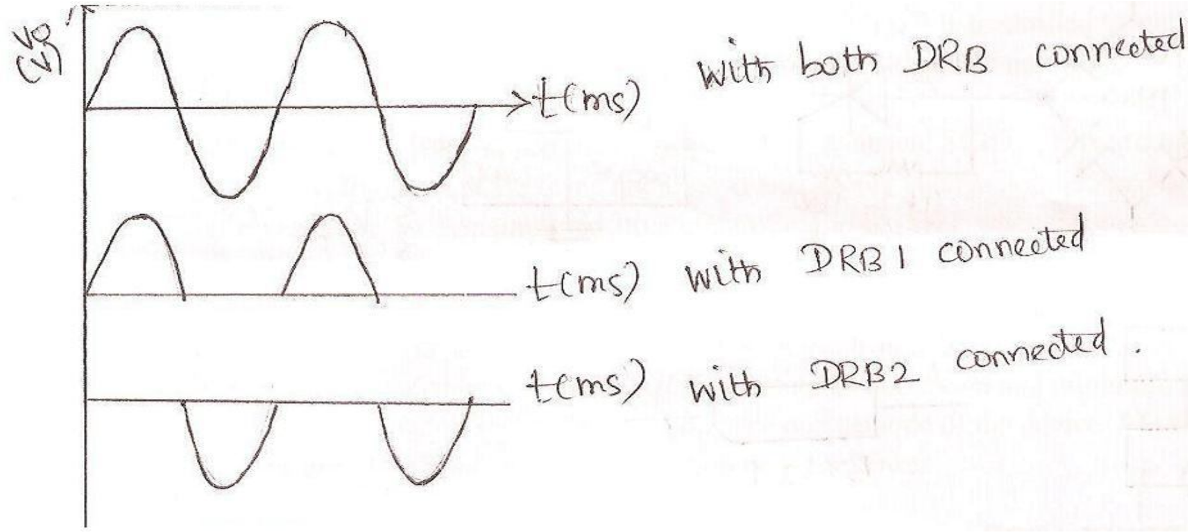
S.No	Name of the Apparatus	Range	Quantity
1	Transformer	230V/24V	1
2	SCR	TYN 604	1
3	Diode	1N4001	4
4	Resistor	10 k	2
5	Bread Board		1
6	Connecting Wires		As required
7	CRO		1
8	DRB		2
9	IC	7812	1
10	Capacitors	1000µf	1
		100µf	1

DC VOLTAGE REGULATOR:

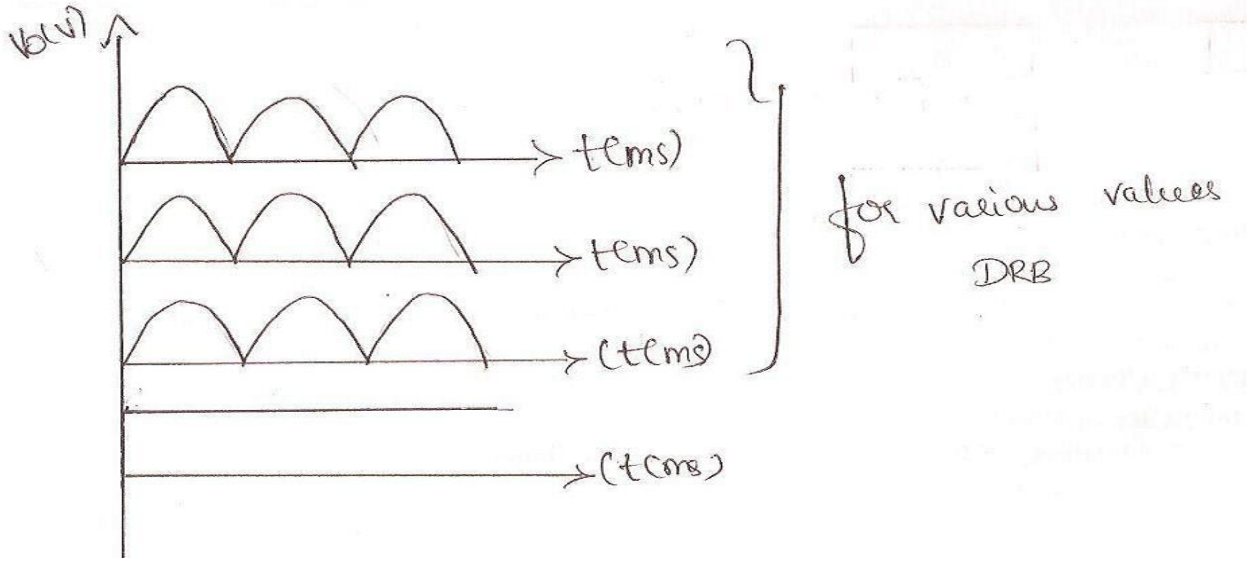


MODEL GRAPH:

AC VOLTAGE REGULATOR:



DC VOLTAGE REGULATOR:



THEORY:

The SCR is switched ON and OFF to regulate the output voltage in AC and DC voltage regulator.

AC VOLTAGE REGULATOR:

If the SCR is connected to AC supply and load, the power flow can be controlled by varying the RMS value of AC voltage applied to the load and this type of power circuit is caused as AC voltage regulator. Applications of AC voltage regulator are in heating on load transformers for changing light controls, speed controls and polyphase controls, induction motors and AC magnet controls for power transfer. Two types of power control are normally used.

i)ON-OFF control

ii)Polyphase Angle control

AC regulators are those converter which converts fixed ac voltage directly to variable ac voltage of the same frequency. The load voltage is regulated by controlling the firing angle of SCRs. AC voltage controllers are thyristor based devices.

The most common circuit is the inverse parallel SCR pair in which two isolated gate signals are applied. Each of the two SCRs are triggered at alternate half cycles of the supply and the load voltage is part of input sine wave. The SCR is an unidirectional device like diode, it allows current flow in only one direction but unlike diode, it has built-in feature to switch ON and OFF. The switching of SCR is controlled by gate and biasing condition. This switching property of SCR allows to control the ON periods thus controlling average power delivered to the load.

In this circuit SCR1 is forward biased during positive half cycle and SCR2 is forward biased during negative half cycle. SCR1 is triggered at the firing angle $\omega t=\alpha$ and supply voltage is impressed on the load resistance(R_L). It conducts from the remaining positive half cycle, turning OFF when the anode voltage becomes zero at $\omega t=\pi$.

SCR2 is triggered at the firing angle $\omega t=\alpha+\pi$ and conducts till $\omega t=2\pi$. Hence the load is alternating in polarity and is part of sine wave. The firing angle of both SCRs is controlled by gate circuit. The conduction period of SCR is controlled by varying gate signals within specified values of maximum and minimum gate currents.

For gate triggering, a signal is applied between the gate and cathode of the device. AC sources are normally used as gate signals. This provides proper isolation between power.

DC VOLTAGE REGULATOR:

If SCR's are used to convert an AC voltage into DC voltage then they are known as DC voltage regulators. Eg. Battery changes for high current capacity batteries in DC voltage control only phase control is used.

The transformer is used to step down the voltage from 230V to 24V. This is given as input to bridge rectifier. The bridge rectifier converts incoming ac signal to unidirectional wave. Therefore we get full wave rectifier output at the output of bridge rectifier. This is given as input to SCR. The gate of SCR is triggered with firing angle of α. During positive half cycle, diode D1 and D2 conducts and during negative half cycle, diode D3 and D4 conducts. The full wave rectified output is given to capacitive

filter. The output of capacitor is dc that it eliminates ripple contents of bridge rectifier output. The dc input is given to regulator IC. The unregulated output must be 2V greater than regulated output voltage. The load current may vary from 0 to rated maximum output current. The output voltage is regulated dc.

TABULAR COLUMN:

AC VOLTAGE REGULATOR:

DRB 1 value(KΩ)	Amplitude (V)	T_{ON}(ms)

DRB 2 value(KΩ)	Amplitude (V)	T_{OFF}(ms)

DC VOLTAGE REGULATOR:

DRB value(KΩ)	Amplitude (V)	T_{ON}(ms)

Resistance R_L(KΩ)	Output (V)

DESIGN:

AC VOLTAGE REGULATOR USING SCR:
Triggering circuit for SCR:

12 V ac is rectified by diode BY 127. SCR 2P4M is used to trigger.

Let the current be 1mA. R=V/I=12V/1mA=12KΩ.

DC VOLTAGE REGULATOR USING SCR:
Triggering circuit for SCR:

24 V ac is rectified by diode 1N4001. SCR TYN604 is used to trigger.

Let the current be 1mA. R=V/I=12V/1mA=12KΩ.

PROCEDURE:

AC VOLTAGE REGULATOR USING SCR:

1. Connections are made as shown in the circuit diagram.
2. The supply is given by means of step down transformer.
3. Anode terminal of SCR1 is connected to the anode terminal of diode, is connected to cathode of SCR1 by means of resistor as the load.
4. Hence the voltage regulation is verified at load terminal.

DC VOLTAGE REGULATOR USING SCR:

1. Connect the two terminals at the top of bridge rectifier.
2. The positive terminal of the bridge rectifier is connected to one terminal at the load and at the other terminal to anode terminal of SCR.
3. The pin 15 connected from the power supply to the load.
4. Then the DC voltage regulation is checked and verified.

RESULT:

Thus AC and DC voltage regulators were designed, constructed and the output waveforms were drawn.

Ex No: 5
Date:

DESIGN OF PROCESS CONTROL TIMER

AIM:

To design an process control timer using relay.

APPARATUS REQUIRED:

1. Transistor – CL100 –2 no.s
2. Relay – 1
3. Diode – IN4001 – 1
4. LED – 1
5. Capacitor – 100 μF-1
6. Resistor- 4.7KΩ. 2.2 KΩ.
7. Regulated Power supply

DESIGN:

$V_C = V_{CC}\ (1-e^{-t/RC}\ )$ ----------------(1)

Where R = 4.7 KΩ.

C = 100 μF

Let the operation voltage be V_{opr} . At t = T, voltage across the capacitor is equal to the sum of the relays operating voltage and the two diode drops of Darlington pair.

The calculation of T is given as follows

$V_C = V_{CC}$

$C_1 = e^{-t/RC}$

From equation (1) at t = 0, $V_C = 0$ and at t = ∝ , $V_C = V_{CC}$

$V_O = V_{CC}\ (1-e^{-t/RC}\ )$, $V_{CC} = 13V$

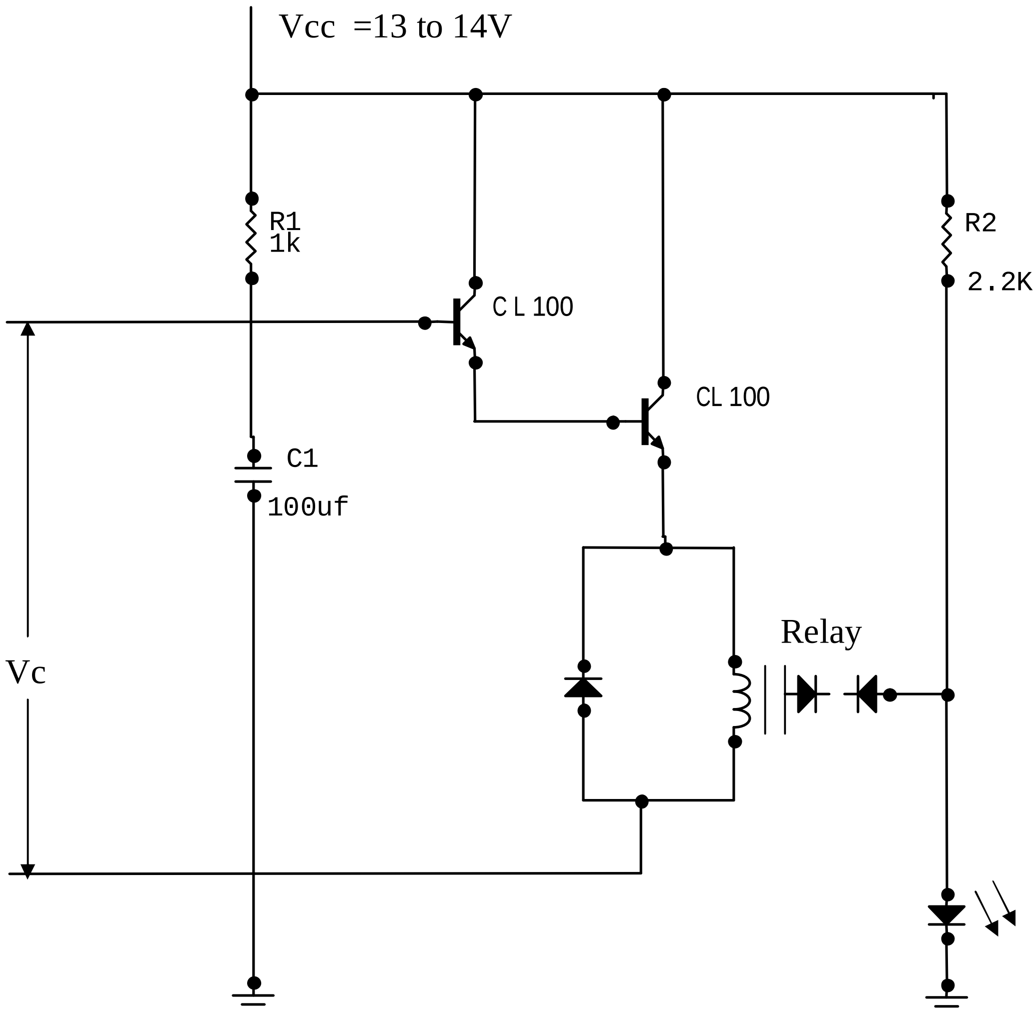
$= 13(1-e^{-t/RC}\ )$

R = 4.7 KΩ. C = 100 μF

$7.97 = 13\ (1-e^{-t/(4.7K\Omega*100\mu F)})$ ant t=6sec.

Which is the theoretical value of time period for switching from one device to another.

CIRCUIT DIAGRAM :



THEORY:

The analog timer circuit shown in the diagram consists of darlington pair and relay circuit connected with proper biasing. The relay circuit is designed to operate at operating voltage V_{opr} which is given by

$V_{opr} = V_{CC} (1-e^{-t/RC}) + 2$ diode drops

Where V_{CC} – supply voltage

t – time period

R and C are the values of biasing resistor and capacitor. Also $V_C = V_{CC} (1-e^{-t/RC})$

When the supply voltage V_{CC} (ranging from 13 to 14V) is given to the circuit, device A is turned ON. The current flowing through the circuit charges the biasing capacitor upto a voltage equal to sum of relay operating voltage and the two diode drop of this voltage is reached. Once this relay lead the switch positions the time taken by the analog timer to switch from one device to another is calculated, whose theoretical value is 6 sec.

PROCEDURE:

1. Connections are given as per the circuit diagram.
2. Now supply voltage of 13V is given and time taken by the relay to switch from one device A to device B (i.e) time taken to switch ON the LED is noted.

RESULT:

Thus the analog timer was designed using relay.

Theoritical value of time taken = -----------

Practical value of time taken = -----------

Ex No: 6(i)

Date:

DESIGN OF AM TRANSCEIVER

AIM:

To transmit a modulating signal after amplitude modulation using VCT-08 and receive the signal back after demodulating using VCT-09.

APPARATUS REQUIRED:

1. VCT-08 trainer kit
2. VCT-09 trainer kit
3. CRO
4. Patch cards

THEORY:

AMPLITUDE MODULATION:

Amplitude Modulation is a process by which amplitude of the carrier signal is varied in accordance with the instantaneous value of the modulating signal, but frequency and phase of carrier wave remains constant.

The modulating and carrier signal are given by

$$V_m(t) = V_m \sin\omega_m t$$

$$V_C(t) = V_C \sin\omega_C t$$

The modulation index is given by, $m_a = V_m / V_C$.

$$V_m = V_{max} - V_{min} \text{ and } V_C = V_{max} + V_{min}$$

The amplitude of the modulated signal is given by,

$$V_{AM}(t) = V_C (1+m_a \sin\omega_m t) \sin\omega_C t$$

Where

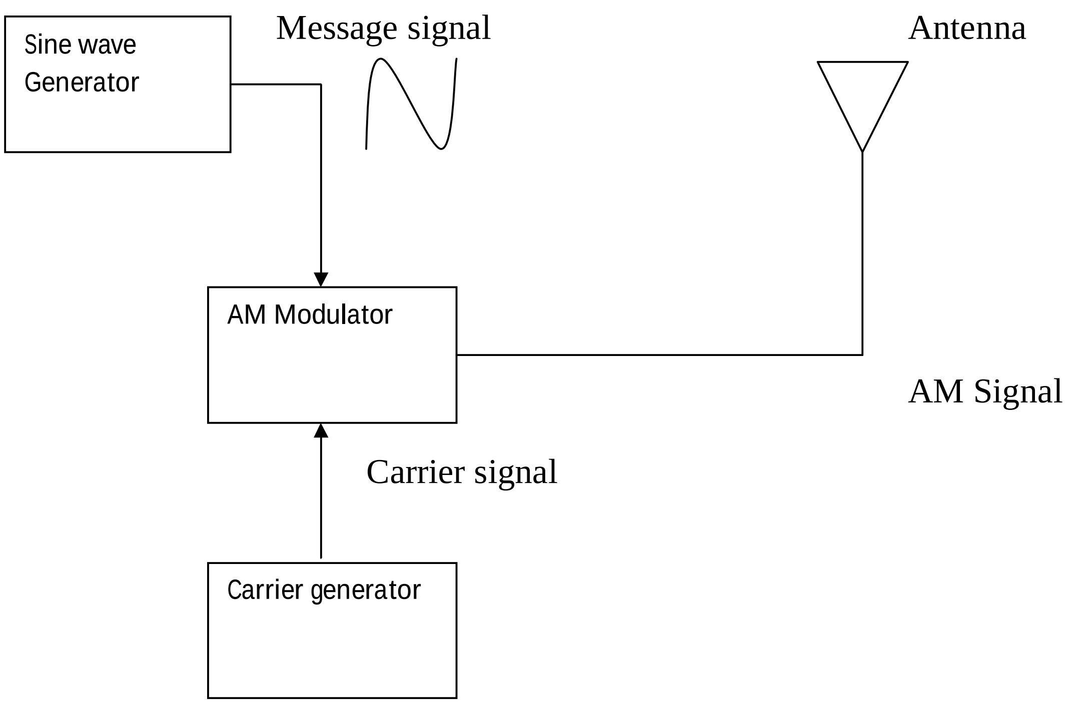
V_m = maximum amplitude of modulating signal

V_C = maximum amplitude of carrier signal

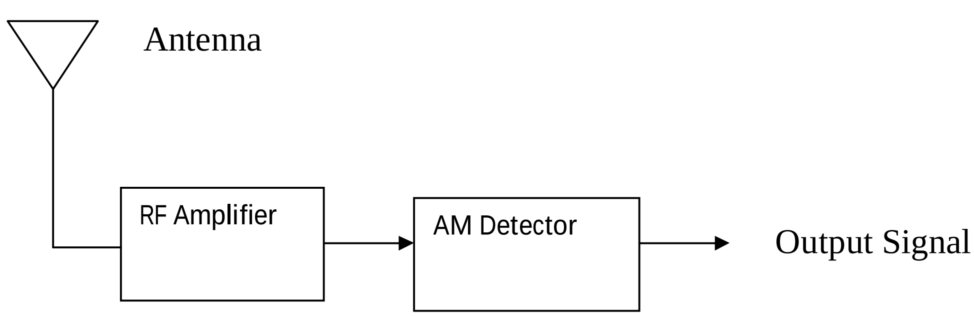
V_{max} = maximum variation of AM signal

V_{min} = minimum variation of AM signal

AM TRANSMITTER



AM RECEIVER



TABULATION:

Waveform	Amplitude (V)	Time Period (msec)	Frequency (KHz)
Modulating Signal Demodulated signal			

PROCEDURE:

1. The circuit wiring is done as shown in diagram
2. A modulating signal input given to the Amplitude modulator can also be given from a external function generator or an AFO
3. If an external signal source with every low voltage level is used then this signal can be amplified using the audio amplifier before connecting to the input of the AM modulator
4. Now increase the amplitude of the modulated signal to the required level.
5. The amplitude and the time duration of the modulating signal are observed using CRO.
6. Finally the amplitude modulated output is observed from the output of amplitude modulator stage and the amplitude and time duration of the AM wave are noted down.
7. Calculate the modulation index by using the formula and verify them.
8. The final demodulated signal is viewed using an CRO at the output of audio power amplifier stage. Also the amplitude and time duration of the demodulated wave are noted down.

RESULT:

The modulating signal is transmitted after amplitude modulation using VCT-08 and the signal is received back after demodulation using VCT-09.

Ex No:6(ii)
Date:

DESIGN OF FM TRANSCEIVER

AIM:

To transmit a modulating signal after frequency modulation using VCT-12 and receive the signal back after demodulating using VCT-13

APPARATUS REQUIRED:

5. VCT-12 trainer kit
6. VCT-13 trainer kit
7. CRO
8. Patch cards

HARDWARE DESCRIPTION OF FM TRANSMITTER TRAINER VCT-12:

The FM transmitter trainer kit VCT-12 has the following section:

1. On-board sine wave generator
2. MIC pre amplifier with a socket for external dynamic MIC
3. Audio amplifier for amplification of low level external input signal
4. Frequency modulation
5. Telescopic whip antenna

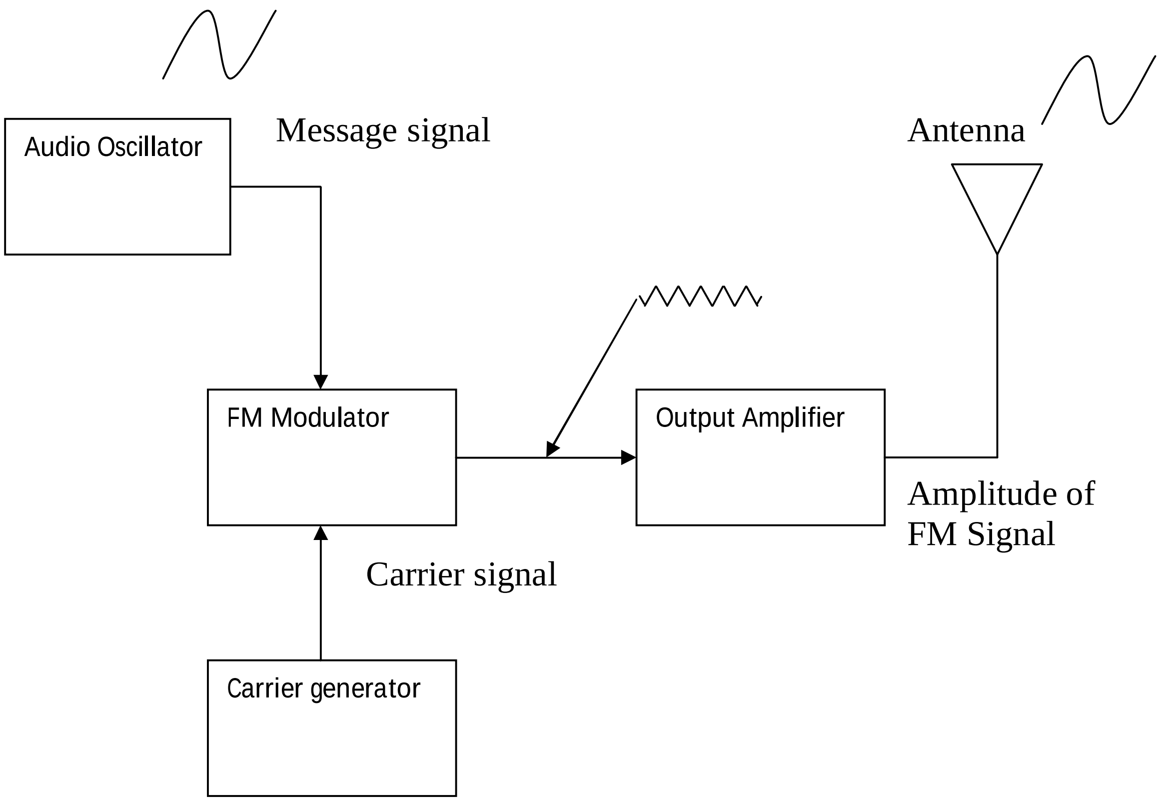
SINE WAVE GENERATOR:

A sine wave generator acts as an on board modulating signal source and generates an audio frequency sine wave .The amplitude of this sine wave generator varies from 0-5 V. However the output voltage from this source is controlled using a Trim pot to get an output signal in the range of 0-3V.The frequency of the signal varies form 300Hz to 15KHz.Since the amplitude of the source is large enough to modulate the carrier it need not be amplified ,instead it can be directly connected to the input of the amplitude modulator .

MIC PRE AMPLIFIER:

The MIC pre amplifier is capable of accurately amplifying even a very low level signal, picked up by the MIC to the required level to modulate the carrier. This section has a EP socket at its input stage where, in an external dynamic MIC can be plugged in the gain of the stage can be controlled by the user by adjusting the potentiometer Pot4.The maximum gain of this stage can be achieved in this is 200.The maximum level of the input signal to this amplifier, so as to produce an amplified output without saturation is 60mV.

FM TRANSMITTER



AUDIO AMPLIFIER:

The audio amplifier stage has a BJT common emitter configuration. This audio amplifier can be used to amplify any lower level external modulating signal whose voltage level is below 100mV.The gain of this stage can also be controlled by the user by varying the pot meter POT-5.The maximum gain of this audio amplifier is 10.

FREQUENCY MODULATION:

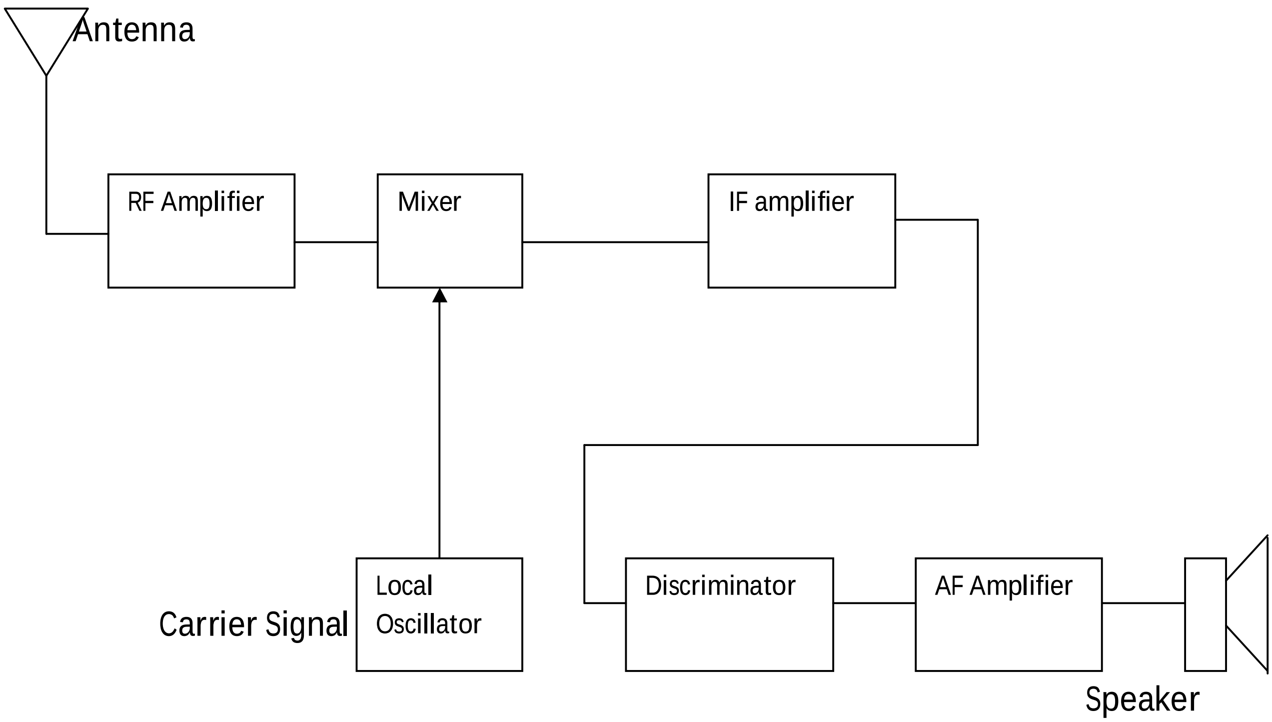
The frequency modulator circuit is constructed around a BF495, high frequency small signal BJT. The collector circuit of the transistor consists of a tank circuit formed by a inductor and capacitor. This tank circuit together with the transistor acts as an oscillator and produces the carrier frequency .The transistor circuit appears to the oscillator as a variable capacitance. This capacitance adds to the capacitance of the oscillator-tuned circuit.

The size of this capacitance depends on the change in the collector current which occurs for a given change in base voltage and this is determined by the Trans conductance of the transistor .The transistor transconductance depends on the bias voltage applied to the transistor base. The larger the bias voltage, the larger the value of gm and the larger the value of gm and the larger capacitance which is added to the capacitance of the oscillator tuned circuit consequently the transistor circuit behaves as a voltage variable capacitance .The bias voltage applied to the transistor base determines the overall capacitance seen by the oscillator and hence the frequency of the carrier. This resulting in FM signal

TELSCOPIC WHIP ANTENNA:

A telescopic whip antenna is used to radiate the AM signal generated by the amplitude modulator.

FM RECEIVER



HARDWARE DESCRIPTION OF FM RECEVIER TRAINER

The Fm receiver trainer VCT-13 has the following sections

1.FM super heterodyne receiver
2.Buffer and filter
3.Audio power amplifier

FM SUPER HETERODYNE RECEIVER:

The FM receiver is built with the dedicated FM receiver IC-CXA1619IC consists of the following sections namely RF amplifier, Mixer and oscillator, IF amplifier and quadrature detector .The circuit details and the description of IC-CXA1619IC are given in appendix

BUFFER AND FILTER:

A buffer is used to prevent any loading to the previous stage .The filter section consists of a BPF with a Pass band to 20KHZ –15MHZ.A notch filter is also included to eliminate the 50Hz power supply noise

AUDIO POWER AMPLIFIER:

The Audio power amplifier is constructed using ICTBA810 to increase the power level of the demodulated message signal to the required level. The gain of this amplifier can be adjusted by the user by varying the pot meter POT-1.the maximum gain of this audio amplifier is 25.the amplified signal can be given to a loud signal which can be extremely plugged into the VCT-13 trainer

TABULATION:

Waveform	Amplitude (V)	Time Period (msec)	Frequency
Modulating Signal			
Demodulated signal			

PROCEDURE:

1. The circuit wiring is done as shown in diagram
2. A modulating signal input given to the Frequency modulator can also be given from a external function generator or an AFO
3. If an external signal source with every low voltage level is used then this signal can be amplified using the audio amplifier before connecting to the input of the FM modulator
4. Now increase the amplitude of the modulated signal to the required level.
5. The amplitude and the time duration of the modulating signal are observed using CRO.
6. The amplitude and time duration of the modulated signal are observed using a CRO and tabulated.
7. The final demodulated signal is viewed using a CRO Also the amplitude and time duration of the demodulated wave are noted down

RESULT: The modulating signal is transmitted after frequency modulation using VCT-12 and the signal is received back after demodulation using VCT-13

Ex No: 7
Date:

DESIGN OF WIRELESS DATA MODEM

AIM:

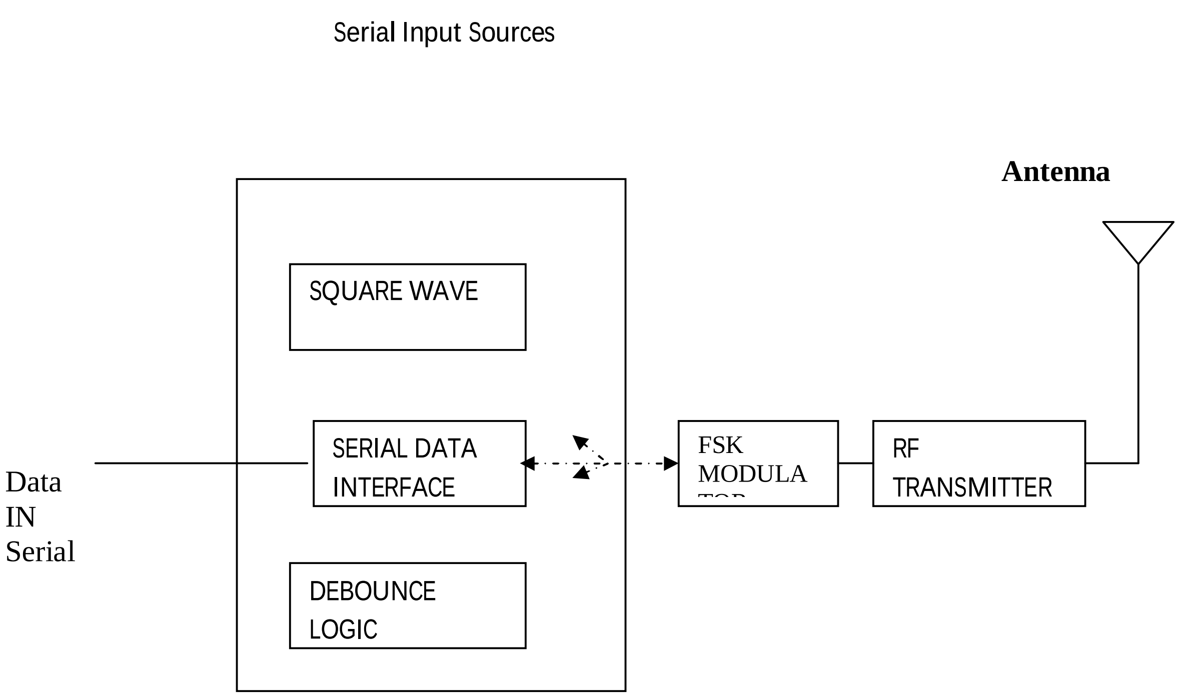
To communicate between two microprocessors using wireless data modems.

APPARATUS REQUIRED:

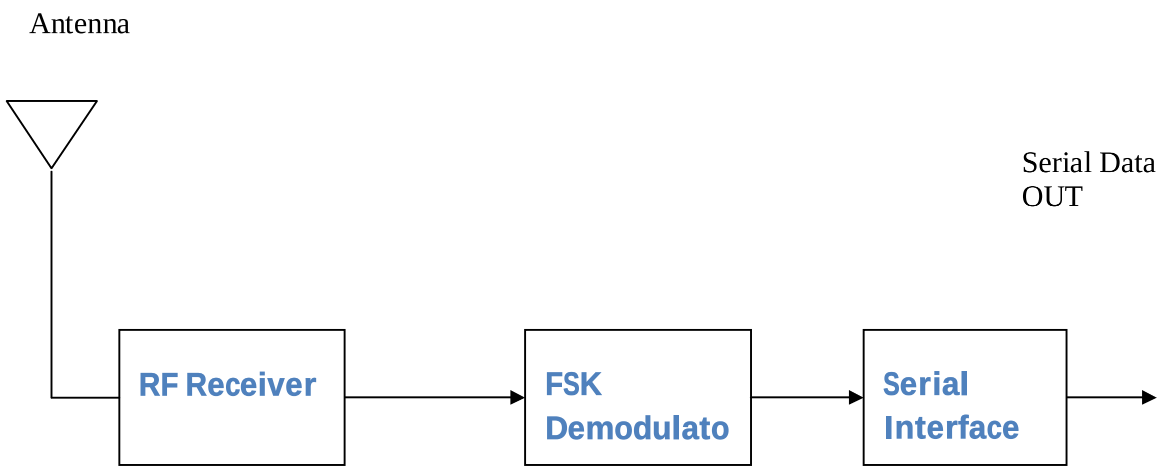
1.8085 microprocessor kit - 2
2. Wireless data modem – 2

DESIGN:

Baud rate calculation:
Baud rate * Required baud rate input to 8251= Required clock
16*300 = 4800
Therefore, Required clock input to 8251 = 4800 Hz
Count value = Clock input to 8253 / Required clock input to 8251
=1.536*10^6 / 4800
= 320 = 140 H.



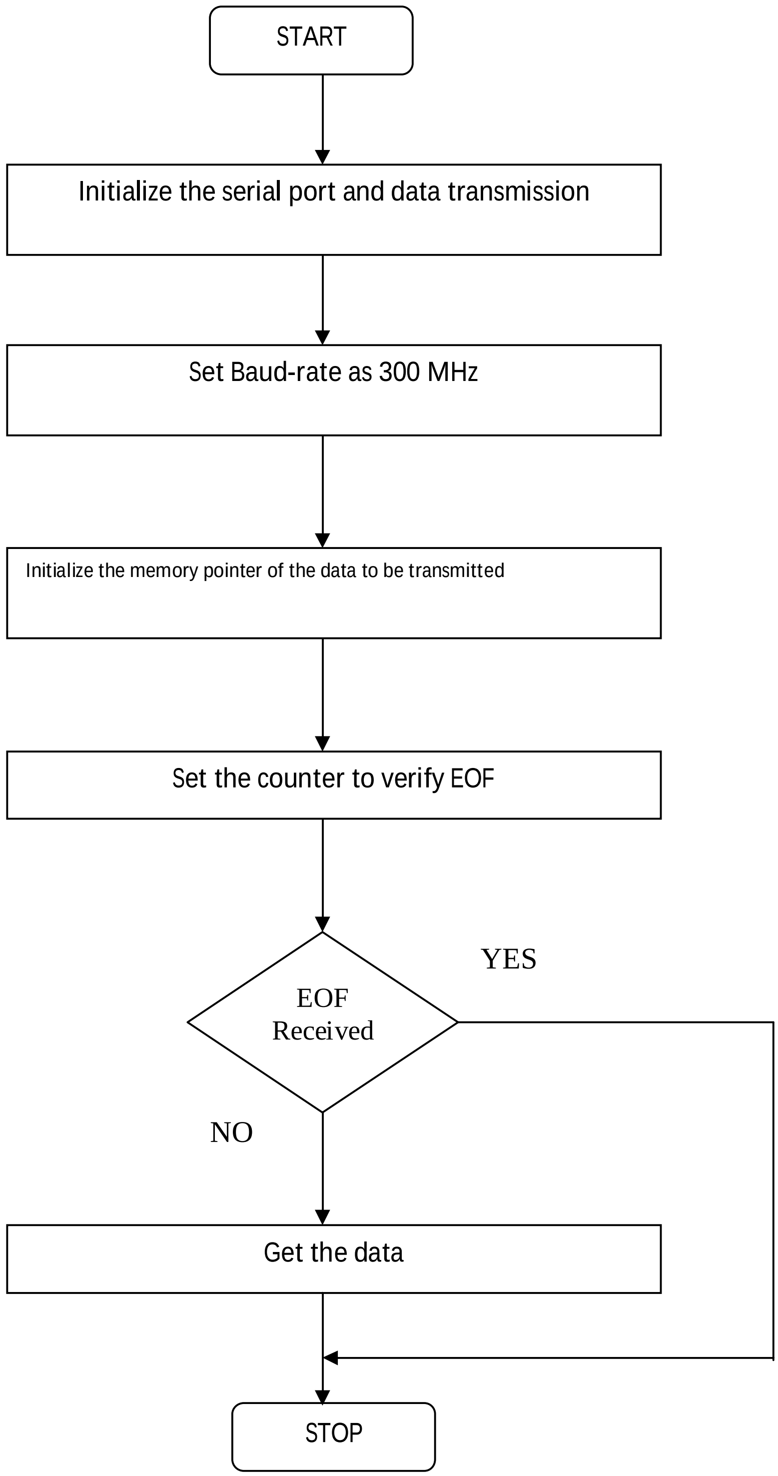
HARDWARE DESCRIPTION OF VCT-10B



ALGORITHM FOR TRANSMITTER:

1. Initialize the serial port for data transmission.
2. Set baud rate as 300.
3. Initialize the memory pointer of the data to be transmitted.
4. Set a counter for verification of EOF.
5. Get the data from the consecutive memory locations and transmit it till EOF is reached.
6. Reset the system.

FLOWCHART FOR TRANSMITTER



PROGRAM FOR TRANSMITTER:

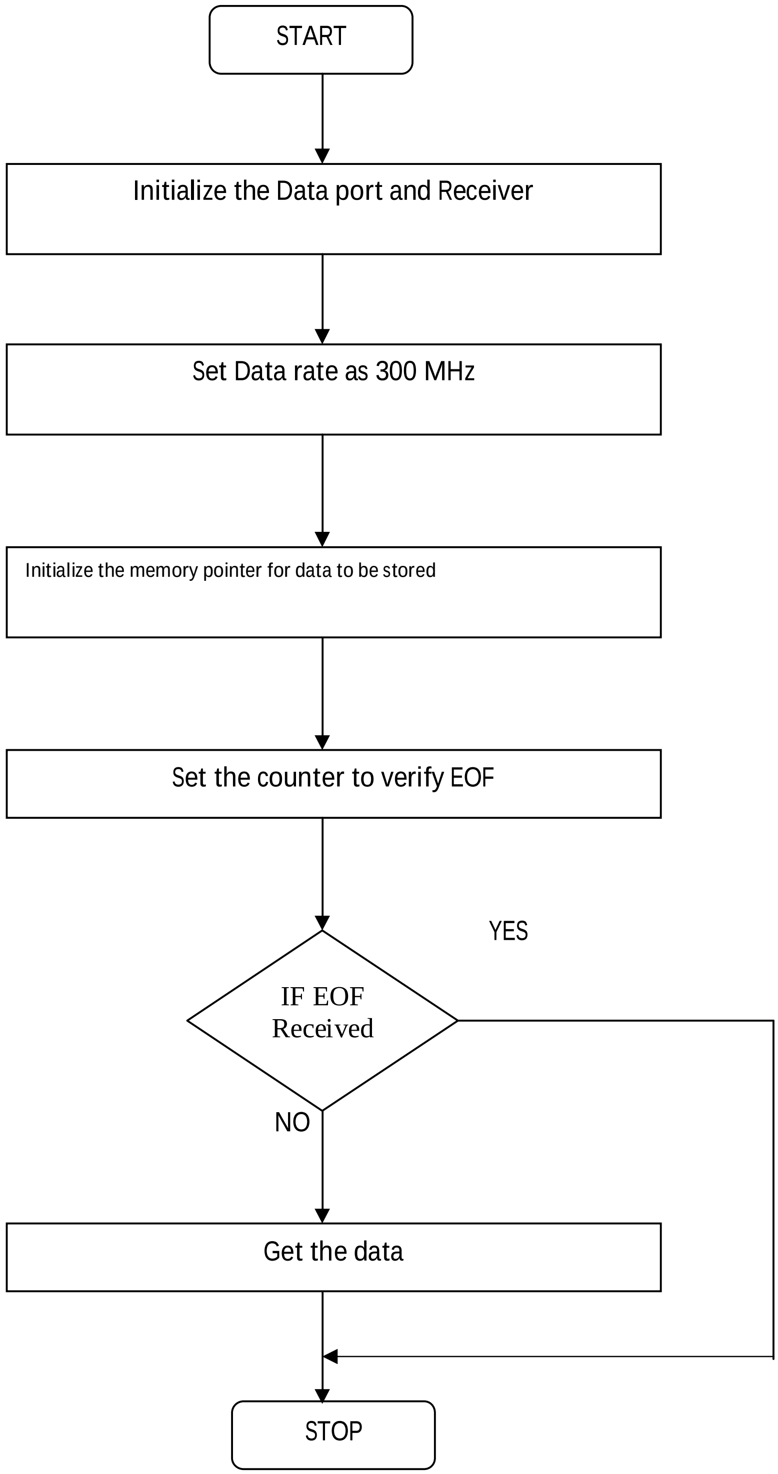
Address	Opcode	Label	Mnemonics	Operand	Comments
4100	21,00,45		LXI	H, 4500H	
4103	3E, 36		MVI	A, 36H	Set the timer
4105	D3, 0B		OUT	0BH	Channel 0 in mode 3
4107	3E, 40		MVI	A, 40H	Set baud rate as 300
4109	D3, 08		OUT	08H	
410B	3E, 01		MVI	A, 01H	
410D	D3, 08		OUT	08H	
410F	0E, 05	RELOAD	MVI	C, 05H	Load count
4111	DB, 05	CHECK	IN	05H	
4113	E6, 04		ANI	04H	Check transmitter empty

4115	CA, 11, 41	JZ	CHECK	
4118	7E	MOVA, M		
4119	D3, 04 OUT	04H		
411B	23	INX H		
411C	FE, 3F	CPI	3FH	Check EOF
411E	C2, 0F, 41	JNZ	RELOAD	
4121	0D	DCR	C	
4122	C2, 11, 41	JNZ	CHECK	
4125	CF	RSTI		Reset

ALGORITHM FOR RECEIVER:

1.Initialize the serial port for data reception.
2.Set baud rate as 300.
3.Initialize the memory pointer for the data to be EOF.
4.Set a counter for verification of EOF.
5.Receive the data and store it in the consecutive memory locations till EOF is reached.
6.Reset the system.

FLOWCHART FOR RECEIVER



Address	Opcode	Label	Mnemonics	Operand	Comments
4100	21,00,45		LXI	H, 4500H	
4103	3E, 36		MVI	A, 36H	Set the timer
4105	D3, 0B		OUT	0BH	Channel 0 in mode 3
4107	3E, 40		MVI	A, 40H	Set baud rate as 300
4109	D3, 08		OUT	08H	
410B	3E, 01		MVI	A,01H	
410D	D3,08		OUT	08H	
410F	0E, 05	RELOAD	MVI	C, 05H	Load count
4111	DB, 05	CHECK	IN	05H	Check receiver is ready
4113	E6, 02		ANI	02	
4115	CA, 11, 41		JZ	CHECK	
4118	DB, 04		IN	04H	

411A	77	MOV	M, A	
411B	23	INX	H	
411C	D3, 04	CPI	3FH	Check EOF
411E	23	JNZ	RELOAD	
4121	FE, 3F	DCR	C	
4122	0D	JNZ		CHECK
4125	CF	RSTI		Reset

TABULATION:

TRANSMITTER		RECEIVER	
ADDRESS	INPUT	ADDRESS	OUTPUT

RESULT:

Thus the communication between two microprocessors is made using wireless data modem.

Ex. No.8
Date:

DESIGN OF AN INSTRUMENTATION AMPLIFIER AND DIGITAL INDICATOR

AIM:

To design, construct and test an instrumentation amplifier using IC 741 and vary its gain from 1 to 100.

APPARATUS REQUIRED:

S.No	Name of the Apparatus	Range	Quantity
1	Operational Amplifier	IC 741	4
2	Resistor	10k 1k 150	10 4 1
3	DRB		1
4	Bread Board &Connecting wires		As required
5	Dual Power Supply		1
6	Rheostat	(0-100)	1
7	Ammeter	(0-250)µA	1
8	Multimeter		1

THEORY:

INSTUMENTATION AMPLIFIER:

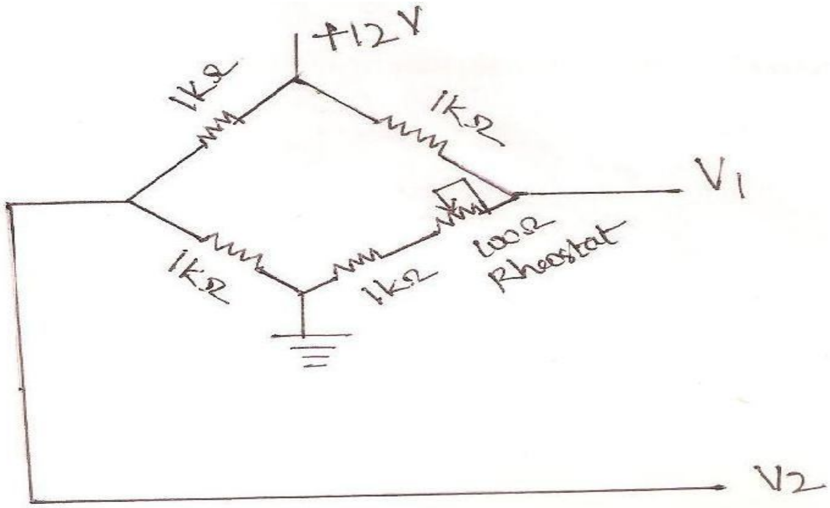
Instrumentation amplifier is generally required in any measurement system using electrical transducers to enhance signal levels often in low voltage less than mV. Also it is required to provide impedance matching and isolation. When the desired input rides over a common mode signal special amplifier are needed so that difference signals get amplified to an acceptable level while the common mode signals get attenuated.

The physical quantities can be converted into electrical quantities by using transducer. The output of the transducer needs to be amplified to get the meter readings. This amplification is done by using instrumentation amplifier. The output of instrumentation amplifier drives of indicator or display system. The important features of an instrumentation amplifier are high gain accuracy, high CMRR, high gain stability with low temperature co-efficient, low dc offset, low output impedance.

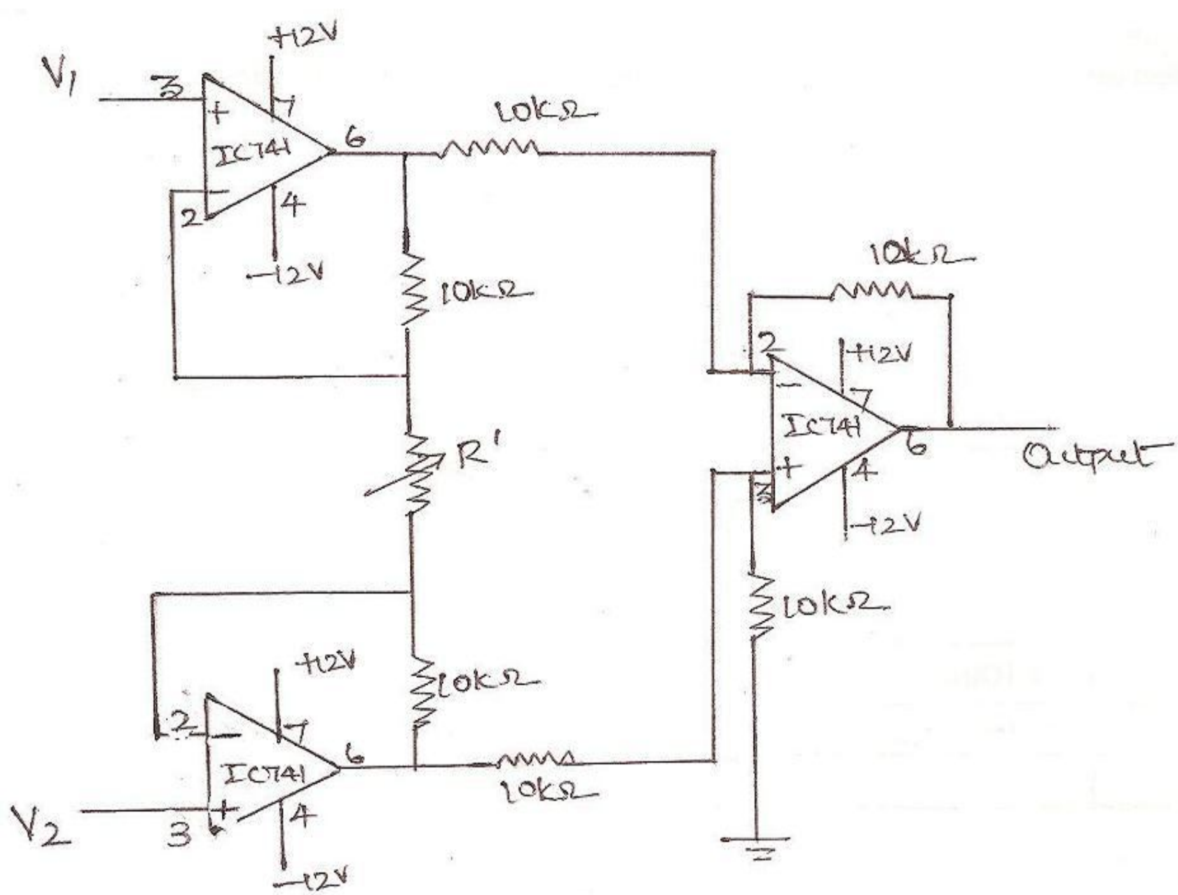
Low input impedance may load the signal source heavily. Therefore high resistance buffer is used preceding each input to avoid this loading effect. For $V_1 = V_2$ under common mode condition. If $V'_2 = V_2$ and $V'_1 = V_1$ both the operational amplifiers act as voltage follower. If V_1 V_2 the circuit has differential gain by the formula V_O/ (V2-V1)=1+(2R/R‘).

CIRCUIT DIAGRAM:

BRIDGE CIRCUIT:



INSTRUMENTATION AMPLIFIER:



DESIGN:

Output voltage $V_O = (1 + (2R / R')) (V_2 - V_1)$

Differential gain $A_d = V_O / (V_2 - V_1)$

$= 1 + (2R / R')$

Choose $R = 10k\Omega$

For A_d max = 100

$100 = 1 + (20k / R')$

$$R' = \frac{20K}{99}$$

R' max = 200Ω.

For A_d min = 10

$10 = 1 + (20k / R')$

R' min = $2.2K\Omega$.

$I_L = I_1 + I_2$

$I_1 = (V-(V_0/2)) / R$

$I_2 = (V_0-(V_0/2)) / R$

$I_L = (V-(V_0/2) + (V_0-(V_0/2)) / R = (V-V_0+V_0) / R = V/R$

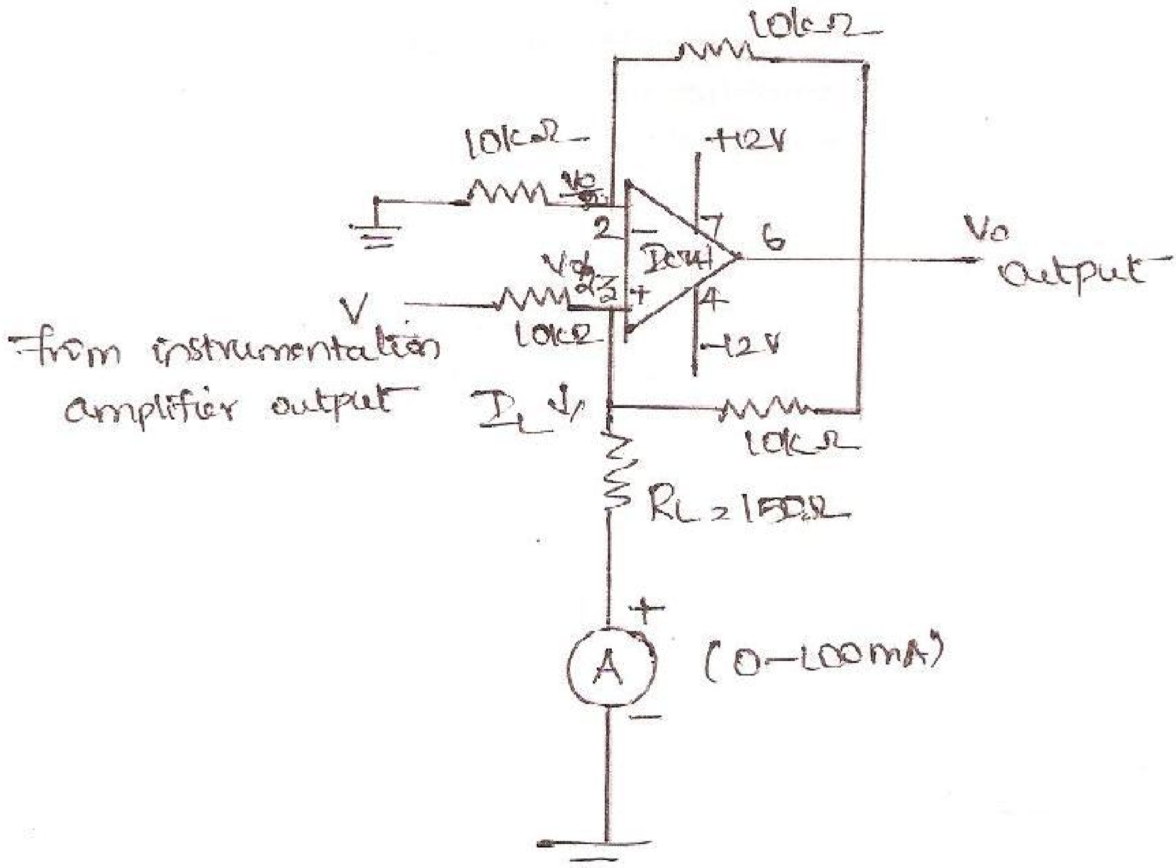
I_L is independent of R_L. If R is constant then I_L V

PROCEDURE:

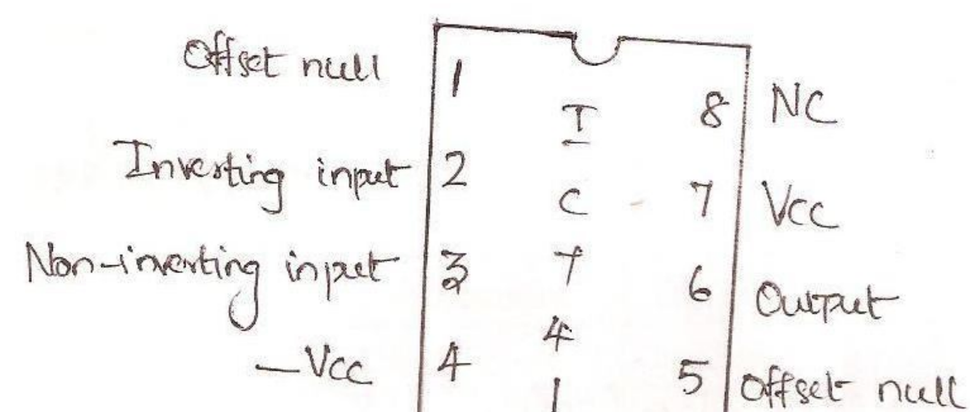
1. The connections are made as per the circuit diagram.
2. The bridge circuit was balanced by varying 100Ω Rheostat.
3. The output voltage V_1 and V_2 of balanced circuit were given as input to the op-amp A_1 and A_2.
4. Varying the resistance R^1 the bridge circuit the voltage V_1 and V_2 were varied.
5. Varying the R' the output voltage was measured then the differential gain was calculated using formula,

$$=20 \log (V_O/(V_2 - V_1)).$$

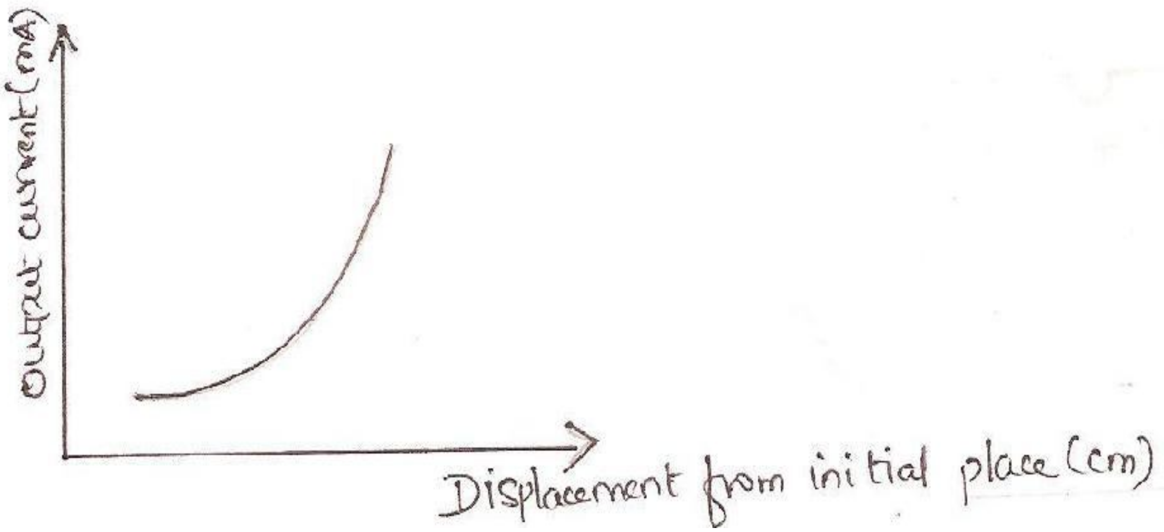
V to I CONVERTER:



PIN DIAGRAM:



MODEL GRAPH:



TABULAR COLUMN:

Displacement from initial place (cm)	Output Voltage (volt)	Output Current (mA)	Gain = $(V_O / (V_2 - V_1))$	Gain = $20 \log (V_O / (V_2 - V_1))$ in dB

RESULT:

Thus the physical quantities are converted into electrical quantities and by using electrical quantities instrumentation amplifier was designed, constructed and outputs were verified.

Ex No: 9
Date:

PCB LAYOUT DESIGN USING CAD

AIM:

To design Component/Board layout, PCB layout of the given circuit using AutoCAD 2000.

PROCEDURE:

1. Double click on AutoCAD 2000 or ACAD.
2. Ensure that you select metric (i.e. you are telling AutoCAD that you will be drawing in metres and millimetres NOT feet and inches) in the dialog box.
3. AutoCAD will now create a new drawing file named drawing1.dwg.
4. Select various electronic components from File→Open→AutoCAD folder→Sample folder→Design Center folder→Analog Integrated Circuits& Basic Electronics& CMOS Integrated Circuits.
5. Thus Component/Board layout is drawn by various AutoCAD commands.
6. Then PCB layout is drawn by various AutoCAD commands.

COMPONENT/BOARD LAYOUT:

PCB LAYOUT:

RESULT:

Thus the Component/Board layout, PCB layout of the given circuit using AutoCAD 2000 was designed.

APPENDIX

AUTOCAD COMMANDS

“CAD is a abbreviation of Computer Aided Design and the term “Auto” indicates the company Name AutoDesk Inc., U.S., developed the Package AutoCAD.

Starting AutoCAD:

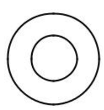
First, your computer should have Windows XP or Win 2000 Operating System.When u switch ON your computer, the Operating System is automatically loaded. Youcan start AutoCad by double clicking on AutoCAD icon on desktop of a computer.

DONUT:

Draws filled circles and rings.

Command: Donut or Do

Specify inside diameter of donut<10.0000>:Enter your value Specify outside diameter of donut<20.0000>:Enter your value Specify center of donut or <exit>:Click any point as center point



VIEWRES:

Sets the resolutions for objects in current view port.

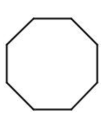
Command:viewers

Do u want fast zooms[yes/no]<Y>: Press enter(fast zooms is no longer a functioning option of this command and remains for script compatibility only)

Enter circle zoom present(1 – 20000)<current>: Enter an integer from 1 – 20000 or press Enter The model is regenerated.

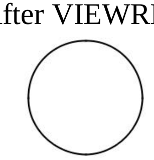
VIEWRES controls the appearance of circles, arcs, ellipses and splines using short vectors. The greater the no of vectors the smoother the appearance of circle or arc. For eg if u create a very small circle and then zoom in it might to appear to be polygon. Using VIEWRES to increase the zoom percentage and regenerate the drawing updates and smoothes the circle appearance. Decreasing the zoom percentage has the opposite effect.

Before VIEWRES



VIEWRES at 15

After VIEWRES

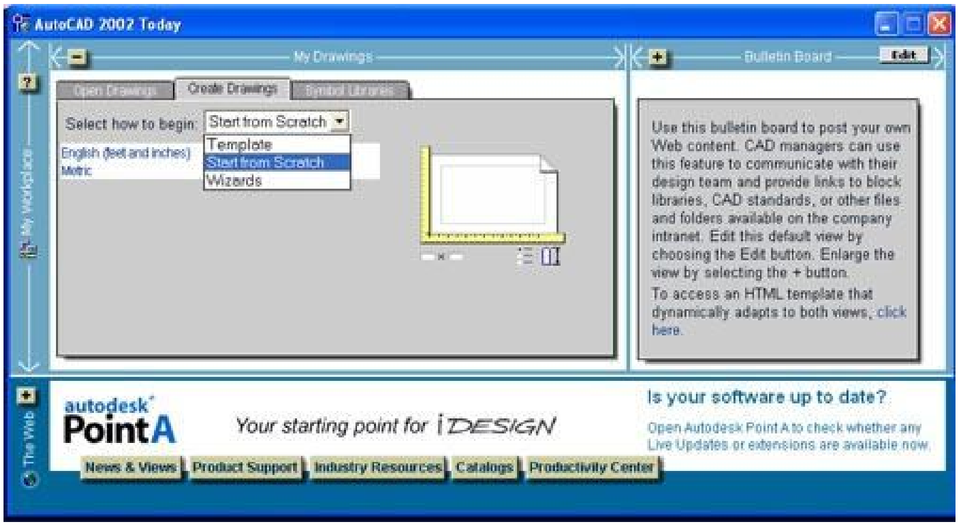


VIEWRES at 500

AutoCAD is a popular program because it can be customized to suit an individual's needs. The toolbars are a good example of this. You can have the toolbars you use most often on the screen all the time. You can easily make them go away so that you have more drawing space. You can also customize them so you have the most common commands on one toolbar. For example, the dimensioning toolbar is one that you will not want taking up space on your screen while drawing, but is very handy when you're dimensioning your drawing.

OpeningAutoCAD:

Open up AutoCAD, you should be greeted with a screen asking if you want to open an existing drawing or start from scratch. (Dependant on your version of AutoCAD, the screen will be slightly different - The image shown below is for AutoCAD 2002).



Select 'Create Drawings', then 'Start from Scratch'. Ensure that you select metric (i.e you are telling AutoCAD that you will be drawing in metres and millimetres NOT feet and inches).

AutoCAD will now create a new drawing file named drawing1.dwg. AutoCAD will default to 'model space'. For now it is sufficient to say that model space is the blank space where all the drawing is carried out. Paperspace (now called Layout space since AutoCAD 2000) isn't really required until we are ready to plot (print) the drawing.

Toolbars

There are many toolbars available in AutoCAD. Go to View > Toolbars from the drop down menu to see them all. For now make sure that the following toolbars are checked:

Draw - Contains AutoCADs most common drawing tools Modify - Contains all of the common editing commands such as erase, copy etc. Object Properties - Contains 'layer' information as well as object colours and line style options. (Covered Later). Standard Toolbar - Contains open & save options as well as zoom & pan options.

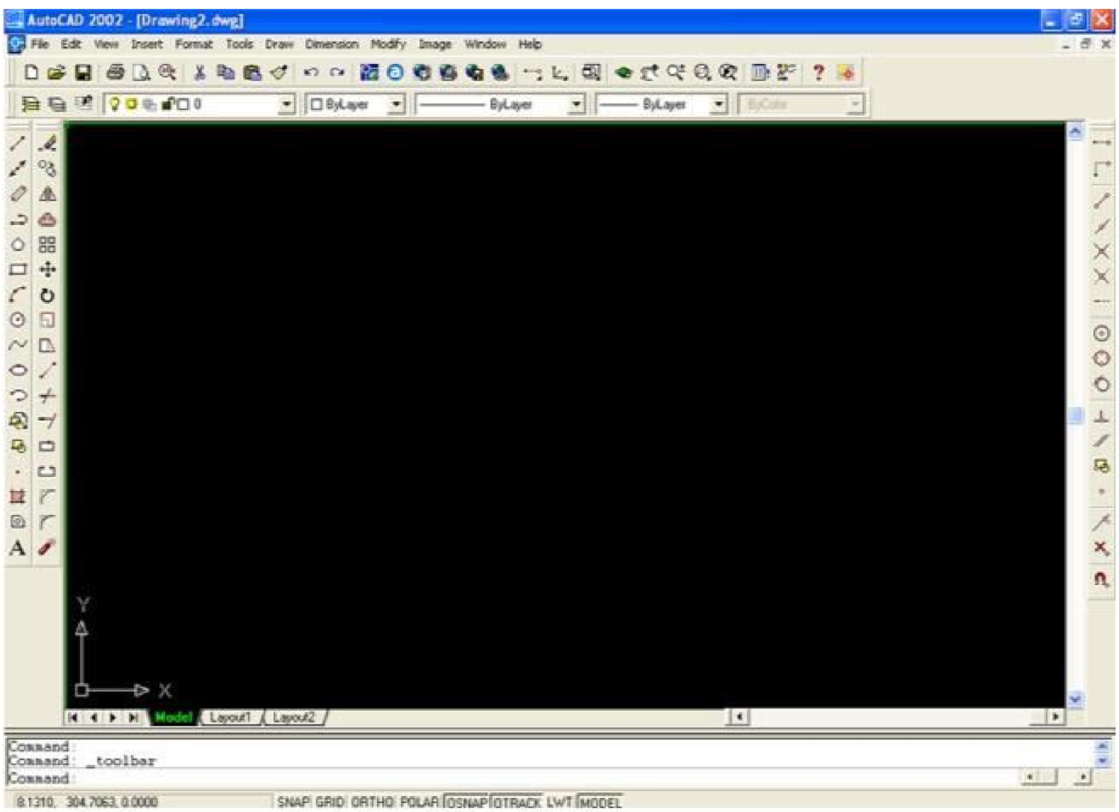
Object Snap - AutoCAD's intelligent drawing aid - joins lines at specific points. (Covered later).

Arrange the icons to where is comfortable for you (A typical layout is shown below): The Command Line

The command line appears at the bottom of the AutoCAD screen (as shown above) and displays the commands entered. Commands can be entered into the command line in text format, or by using the icons or drop down menus. 'Old School' Cad users tend to type each command into the command line, as was required with older versions of AutoCAD. It is much quicker to familiarise yourself with the tool bars and drop down menus. There are times however when commands need to be typed into the command line, these will be covered later.

<u>Drawing Technique - AutoCAD's Co-ordinate system</u>

Just before we start drawing, one more important point. AutoCAD works on a co-ordinate system. When drawing, we can be very precise and specify an exact point in space where a line should begin or end. The 2D co-ordinates system is based on the horizontal and vertical axis named x and y. (This is shown in the bottom left of the AutoCAD drawing area, the X Y icon is called the UCS).



Title Bar - This will show you what program you are running and what the current filename is.

- Pull-down menus - These are the standard pull-down menus through which you can access almost all commands.
- Main toolbar - This has most of the standard Windows icons, as well as the most common AutoCAD commands.
- Property toolbar - This toolbar gives a way to quickly modify an object's properties, such as layer and linetype.
- Floating toolbar - This is a toolbar that can be moved around the screen, or 'docked' as the main toolbar is.
- Drawing space - This is where you draw. You have an almost infinite area to draw and this is just a 'section' of the entire space.
- Scrollbars - These work like in other windows programs. You can also use the PAN command to move around your drawing.
- WCS Icon - This is here to show you which direction positive X and positive Y go. The W means you're in the World Co-ordinate System. (It can be changed to a User Co-ordinate System.)
- Status Bar Tray Icons - These icons give you updates on items like reference files program updates and print status.
- Command line - When you type a command, you will see it here. AutoCAD uses this space to 'prompt' you for information. It will give you a lot of information and tell you where you are in the command. Watch this line while learning.
- Status bar - This allows to see and change different modes of drawing such as Ortho, Osnaps, Grid, Otrack, etc.
- Tool Palette - Collection of tools in one area that can be organized into common catagories.

Command	Keystroke	Icon	Menu	Result
Properties	PROPERTIES		Modify > Properties	Displays the properties of the object in the Properties Palette

Ex.No.10
Date:

MICROCONTROLLER BASED SYSTEMS DESIGN

MICROCONTROLLER BASED SYSTEM DESIGN

EXPT NO: 7

AIM:

To interface a stepper motor with 8051 micro controller and operate it.

APPARATUS REQUIRED:

1.8051 micro controller kit
2. Stepper motor
3. Interface card

THEORY:

A motor in which the rotor is able to assume only discrete stationary angular position is a stepper motor. They are used in printer, disk drive process control machine tools etc.

Two-phase stepper motor has two pairs of stator poles. Stepper motor windings A1, A2, B1, B2 are cyclically excited with a DC current to run the motor in clockwise direction and reverse phase sequence A1, B2, A2, B1 in anticlockwise stepping

Two-phase switching scheme:

In this scheme, any two adjacent stator windings are energized.

Anticlockwise						Clockwise					
Step	A1	A2	B1	B2	Data	Step	A1	A2	B1	B2	Data
1	1	0	0	1	9 H	1	1	0	1	0	A H
2	0	1	0	1	5 H	2	0	1	1	0	6 H
3	0	1	1	0	6 H	3	0	1	0	1	5 H
4	1	0	1	0	A H	4	1	0	0	1	9 H

Address Decoding logic:

The 74138 chip is used for generating the address decoding logic to generate the device select pulses CS1 and CS2 for selecting the IC 74175 in which latches the data bus to stepper motor driving circuitry.

Address	Opcode	Label	Mnemonics	Operand	Comments
4100	90 41 1F	START	MOV	DPTR # TABLE	Load the start address of switching scheme data TABLE into Data pointer.
4103	78 04		MOV	R0, #04	Load the count in R0
4105	F0	LOOP	MOV X	A, @ DPTR	Load the number in TABLE into A
4106	C0 83		PUSH	DPH	Push DPTR Value to stack
4108	C0 82		PUSH	DPL	
410A	90 FF C0		MOV	DPTR, # 0FFFC0	Load the motor port address into DPTR.
410D	F0		MOV X	@ DPTR, A	Send the value in A to stepper motor port address
410F	7C FF		MOV	R4,#0FFH	Delay loop to cause a specific amount of time delay before next data item is sent to the motor
4110	7D FF	DELAY	MOV	R5,#0FFH	
4112	DD FE	DELAY1	DNZ	R4, DELAY 1	
4114	DC FA		DJNZ	R4,DELAY	
4116	D0 82		POP	DPL	POP back DPTR value from stack
4118	D0 83		POP	DPH	
411A	A3		INC	DPTR	Increment DPTR to point to next item in the TABLE
411B	D8 E8		DJNZ	R0, LOOP	Decrement R0, if not zero repeat the loop
411D	80 E1		SJMP	START	Short jump to start of the program to make the motor rotate continuosly.
411F	09 05 06 0AH	TABLE	DB	09 05 06 0AH	Value as per two phase switching scheme.

RESULT:

Enter the above program starting from location 4100 and execute the same, stepper motor rotates. Varying the count at R4 and R5 can vary the speed. Entering the data in the look-up TABLE in the reverse order can vary the direction of rotation.

Ex. No.11
Date:

DESIGN A DSP BASED SYSTEM FOR ECHO CANCELLATION

AIM:

To write A Matlab program for echo cancellation.

SOFTWARE USED:

Matlab

PROGRAM:

```
clc; clear all; close all; format
short
T=input('enter the symbol interval T');
br=input('enter the bit rate value br');
rf=input('enter the roll off factor rf'); n=[-10
10]; y=5000*rcosfir(rf,n,br,T);
ds=[5 2 5 2 5 2 5 2 5 5 5 5 2 2 2 5 5 5 5];
m=length(ds);
n1=length(y);
i=1;
z=conv(ds(i),y); while
 (i)
     z1=[z,zeros(1,1.75*br)];
     z=conv(ds(i+1),y);
     z2=[zeros(1,i*1.7*br),z];
     z=z1+z2;
     i=i+1;
 end %plot(z);
h=randn(1,length(ds));
    rs1=filter(h,1,z); for
        i=1;length(ds),
        rs(i)=rs1(i)/15;
end
for i=1:round(x3/3),
   rs(i)=randn(1);
end
fs=[5 5 2 2 2 2 2 5 2 2 2 5 5 5 2 5 2 5 2];
m=length(ds);
n1=length(y);
i=1;
z=conv(fs(i),y);
while(i)
    z1=[z,zeros(1,1.75*br)];
    z=conv(fs(i+1),y);
    z2=[zeros(1,i*1.75*br),z];
z=z1+z2;
 i=i+1; end
```

```
fs1=rs+fs;
ar=xcorr(ds,ds);
crd=xcorr(rs,ds);
l1=length(ar);
j=1;
for i=round(11/2):11, ar1(j)=ar(i); j=j+1;

end r=toeplitz(ar1); l2=length(crd);
j=1;
for i=round(12/2):12, crd1(j)=crd(i); j=j+1;

end p=crd1;
lam=max(eig(r));
la=min(eig(r));
l=lam/la;
w=inv(r)*p; e=rs-filter(w,1,ds);
s=1;mu=1.5/lam; ni=1;
while(sle -10) w1=w-2*mu*(e.*ds); rs
 y4=filter(w1,1,ds); e=y4-rs;
 s=0;e1=xcorr(e);

 for     i=1:length(e1),     s=s/length(e1);
   if(y4==rs)
     break end ni=ni+1; w=w1;
 end figure(1); subplot(2,2,1);
plot(z);

title('near end signal'); subplot(2,2,2);
plot(rs);
title('echo produced in the hybrid'); subplot(2,2,3);
plot(fs); title('desired
signal'); subplot(2,2,4);
plot(fs1);
title(' echo added with desired signal');
figure(2);
subplot(2,1,1);
plot(y4);
title('estimated echo signal using LMS algorithm');
subplot(2,1,2);
plot(fs1-y4);
title('echo cancelled signal');
```

RESULT:

Thus the LMS Algorithm based Echo cancellation System has been designed and verified using MATLAB.