AVIT
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY
VINAYAKA MISSION'S RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)
Accredited by NAAC
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

LINEAR INTEGRATED CIRCUITS & MICROCONTROLLERS LAB

Program/ Branch	**: B. E., / ECE**
Year / Semester	**: II/ IV**
Academic Year	**: 2020 – 2021 (Even Semester)**
Regulation	**: R 2017**

HOD / ECE

17ECCC85	LINEAR INTEGRATED CIRCUITS & MICROCONTROLLERS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To provide the skill to design linear integrated circuits using op-amp and other special purpose circuits. Assembly language programming for microcontroller and interfacing peripheral devices with microcontroller is vital due to the persisting real time application scenarios. Hence exposure to interface ADCs, DACs with microprocessor and acquiring knowledge about the real time applications like stepper motor control, key board etc., is essential.

PRERQUISITE

17ECCC01 - Semiconductor Devices
17ECCC02 - Analog Circuits

COURSE OBJECTIVES

1	To learn the characteristics of integrated circuits through op-amp.
2	To implement various operations using Op-amp
3	To write the assembly language program for 8086 and 8051.
4	To write the programs for communication between microcontroller and peripheral devices

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Determine Gain of inverting and Non inverting Amplifier using Op-Amp	Apply
CO2. Analyze and Implement various circuits Applications like integrator, differentiator, Comparator etc, using Op-amp.	Analyze
CO3. Design and test the performance of multi-vibrators for given specifications using timer IC	Analyze
CO4. Develop assembly language program for basic applications like arithmetic operations, interrupt and UART, etc	Analyze
CO5. Apply the practical knowledge of Microcontroller in designing various Circuit.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	M	L	-	-	-	-	M	-	L	-	M	-	M	-	-
CO2	M	L	-	-	-	-	M	-	L	-	M	-	M	-	-
CO3	M	L	-	-	-	-	M	-	M	-	M	-	M	-	-
CO4	M	L	-	-	-	-	M	-	M	-	M	-	M	-	-
CO5	M	L	-	-	-	-	M	-	M	-	M	-	M	-	-

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS:

LINEAR INTEGRATED CIRCUITS LAB

Design

1. Inverting, Non-Inverting and Differential Amplifier.
2. Integrator, Differentiator, Comparator and Schmitt trigger.
3. Active LPF and HPF.
4. Astable and Monostable Multivibrators using IC 555
5. Voltage regulation using IC 723

MICROCONTROLLERS LAB

6. 8086 & 8051 Assembly language program for Arithmetic Operations.
7. 8051 Assembly language program for Logical, Interrupt & UART Operations.
8. Interfacing DAC to Microcontroller and generate Square, Triangular and Saw –tooth waveforms.
9. Interfacing ADC to Microcontroller.
10. Interfacing Stepper Motor to 8051 and operate it in Clockwise and Anti-Clockwise directions.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.N.Manikanda Devarajan	Assistant Professor	ECE	manikandadevarajan@vmkvec.edu.in
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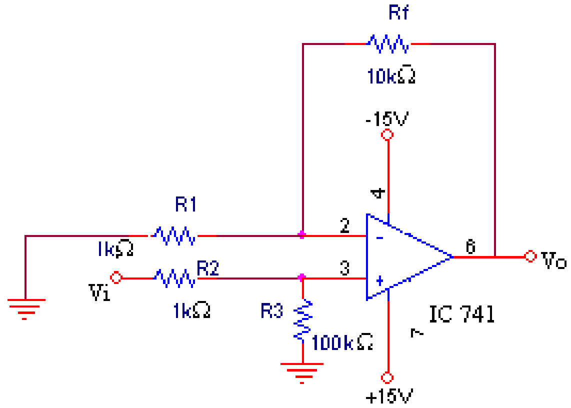
CIRCUIT DIAGRAM:



Inverting amplifier

PINDETAILS

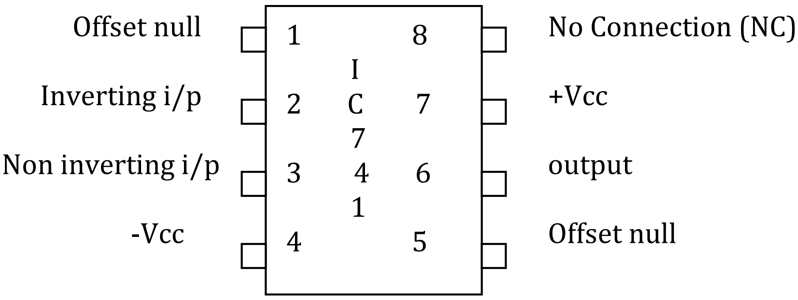


Fig1.2

1. INVERTING, NONINVERTING, AND DIFFERENTIAL AMPLIFIER

AIM:

To study the operation of inverting, non-inverting and Differential amplifier using IC741.

APPRATUS REQUIRED:

S.NO	COMPONENTS	RANGE	QUANTITY
1	Op-amp	IC741	1
2	Resistor	1kΩ,10 kΩ	1
3	Bread board		1
4	Dual power supply	(0-30)v	1
5	CRO	(0-3) MHz)	1
6	Signal generator	(0-3) MHZ	1

INVERTING AMPLIFIER:

THEORY:

An amplifier which provides a phase shift of 180º between input and output is called inverting amplifier. The input signal is applied to the inverting terminal In this mode of operation the positive input terminal of an amplifier is grounded and the input voltage is applied to the negative input terminal through resistor R_1 .The feedback applied through resistor R_f from the output to the negative input terminal. The output of such amplifier is inverted as compared to the input terminal**.**

$A=- R_f/R_1$

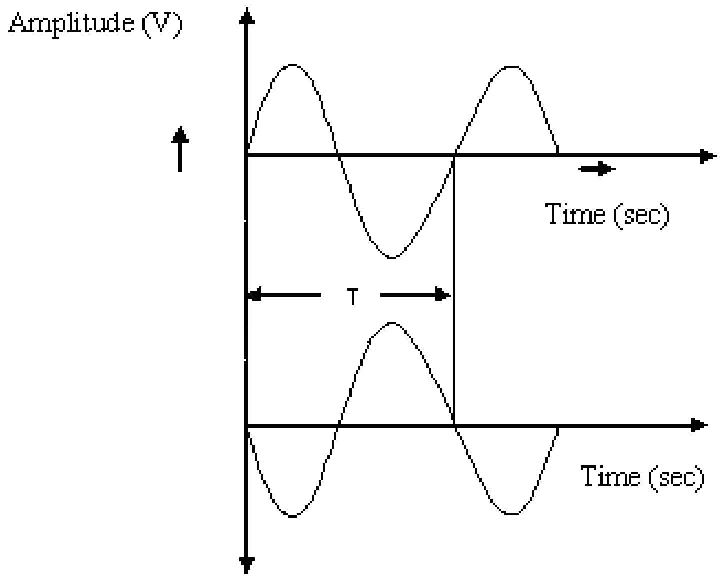
R_f=Feedback resistor

$R_{1=}$ input resistor

PROCEDURE:

1. Connections are given as per the circuit diagram.
2. Connect the dual supply voltage of -15v and +15v to op-amp
3. Set the i/p voltage.
4. Using the probes obtain the input from the CRO. Tabulate the voltage and time period
5. using the probes obtain the output from the CRO .Tabulate the voltage and time Period, compare with the input.
6. Plot the graph between the voltage on the x axis and time period on the y axis.

MODEL GRAPH



I/P&O/P Waveforms

TABULATION

	Amplitude (volts)	Time period (ms)
Input		
Output		

NON - INVERTING AMPLIFIER

THEORY:

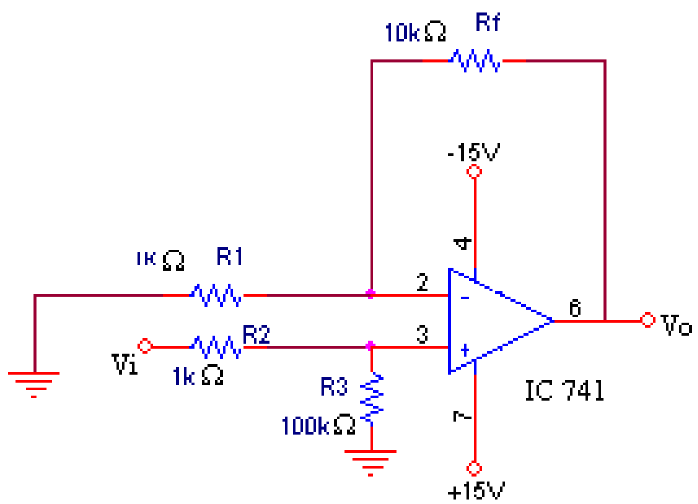
An amplifier which amplifies the input without producing any phase shift between input and output is called non – inverting amplifier. The input is applied to the non inverting terminal of the op-amp. In this mode of operation the Negative input terminal of an amplifier is grounded and the input voltage is applied to the Positive input terminal through resistor R_1 .

$$V_O = (1 + R_f/R_1)V_{In}$$

PROCEDURE:

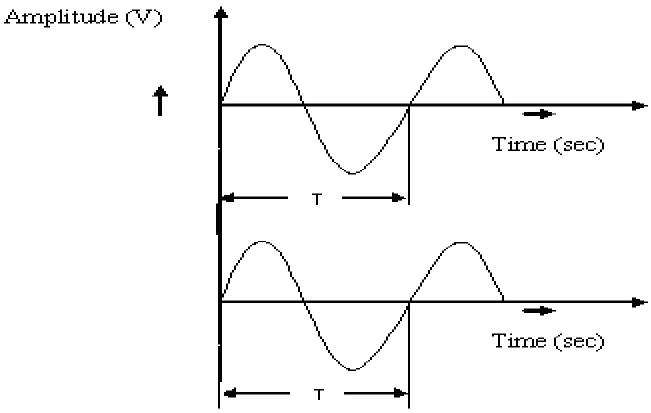
1. Connections are given as per the circuit diagram.
2. Connect the dual supply voltage of -15v and +15v to op-amp
3. Set the i/p voltage.
4. using the probes obtain the input from the CRO.
5. using the probes obtain the output from the CRO .Tabulate the voltage and time period, compare with the input.
5. Plot the graph. Plot the graph between the voltage on the x axis and time period on the y axis.

CIRCUIT DIAGRAM:



Non - inverting amplifier

MODEL GRAPH



I/P&0/P Waveforms

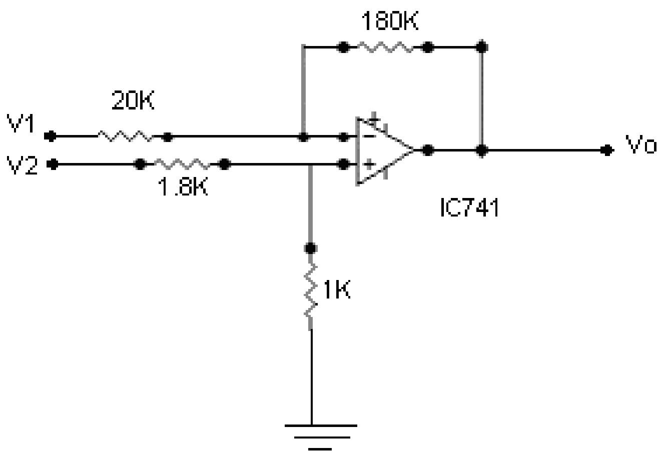
TABULATION

	Amplitude (volts)	Time (ms)
Input		
Output		

REVIEW QUESTIONS

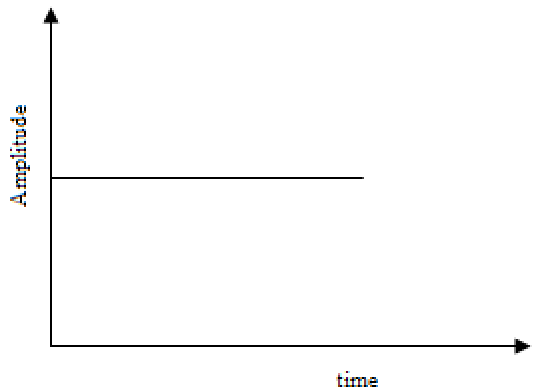
1. What is mean by Operational amplifier?
2. Mention the characteristics of an operational amplifier.
3. What is the gain formula for Inverting amplifier?
4. What kind of feedback is used in inverting amplifier?
5. What is the concept of virtual short in Op-Amp?

CIRCUIT DIAGRAM



Differential Amplifier

MODEL GRAPH



TABULATION

	Amplitude (volts)	Time (ms)
Input		
Output		

RESULT:

Thus the inverting, non-inverting and Differential amplifier using IC741.

2. Integrator, Differentiator, Comparator and Schmitt trigger.

AIM:

To study the operation of Integrator, Differentiator, Comparator and Schmitt Trigger using IC741.

APPRATUS REQUIRED:

S.NO	COMPONENTS	RANGE	QUANTITY
1	Op-amp	IC741	1
2	Resistor	1kΩ,10 kΩ	1
3	Bread board		1
4	Dual power supply	(0-30)v	1
5	CRO	(0-3) MHz)	1
6	Signal generator	(0-3) MHZ	1

INTEGRATOR

THEORY

In an integrator circuit, the output voltage is the integration of the input voltage. The integrator using an active device like op – amp is called as an active integrator. The limitations of an ideal integrator can be minimized by the practical integrator circuit which uses resistance in parallel with the capacitor.

A I circuit in which the output voltage waveform is the integral of the input voltage waveform is the integrator or the integration amplifier.

$$Vo=1/R1C1 * \int_0^t vin\, dt + c$$

V_o = output voltage

R_1 = input resistance

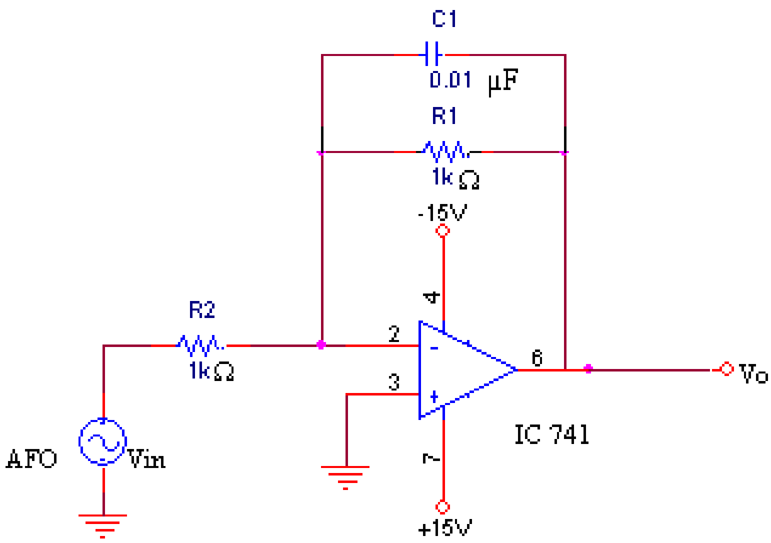
C_F = feedback capacitor

v_{in} = input voltage

PROCEDURE:

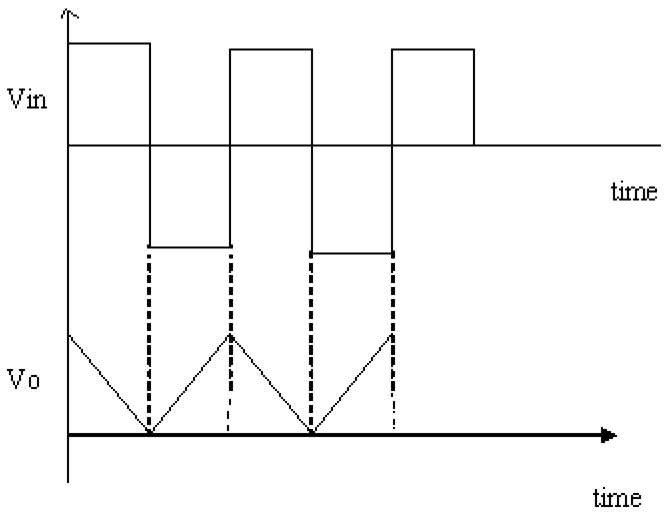
1. Connections are made as per the circuit diagram.
2. Connect the dual supply voltage of +15V and -15V to bias the Opamp.
3. A Sine wave of 1Vpp at 2KHz is given as input to pin 2.
4. A Sine wave of 1.5Vpp at 2KHz is given as input to pin 3.
4. using the probe obtain the Output waveform from the CRO.
5. Amplitude and time period readings are tabulated.
6. Plot the graph between the voltage on the x axis and time period on the y axis.

CIRCUIT DIAGRAM



Integrator

MODEL GRAPH

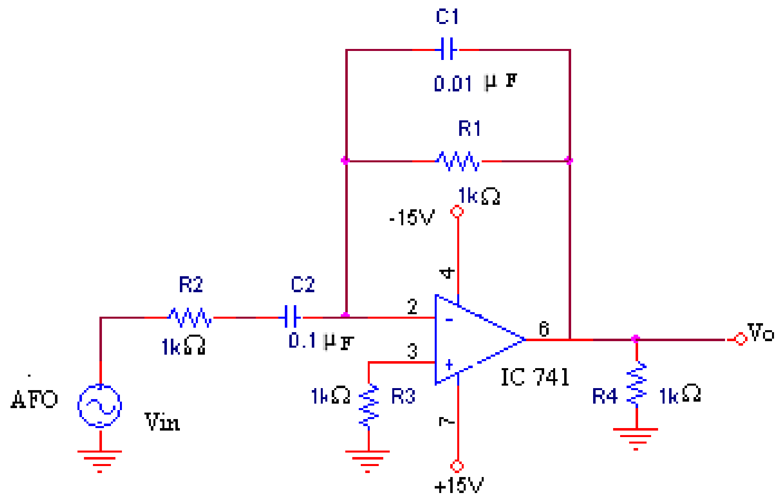


I/P&O/P Waveforms

TABULATION

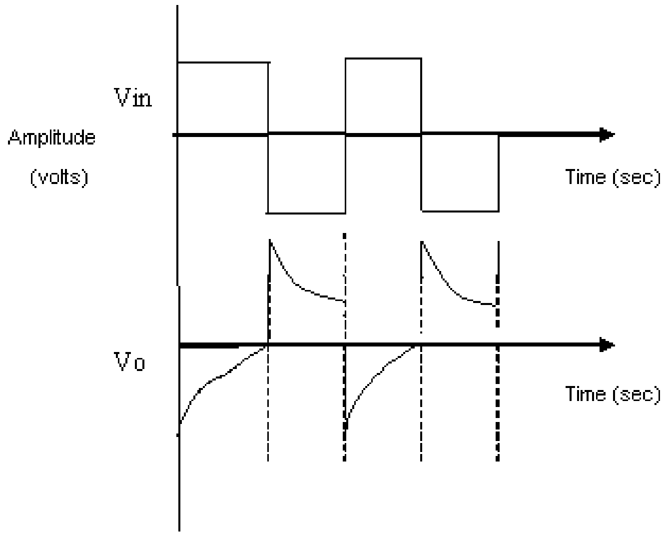
	Amplitude (Volts)	Time (ms)
Input		
Output		

CIRCUIT DIAGRAM:



Differentiator

MODEL GRAPH

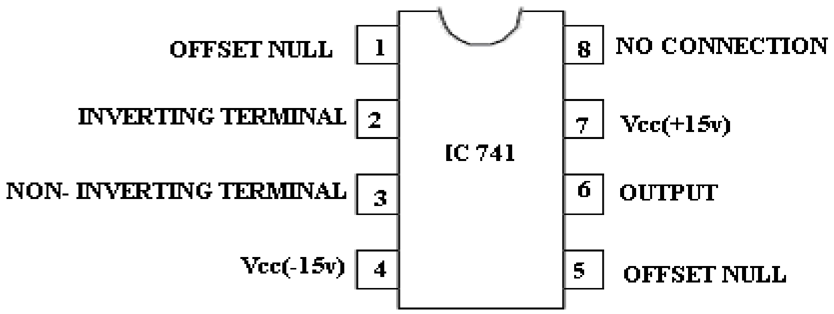


I/p & O/p waveforms

TABULATION

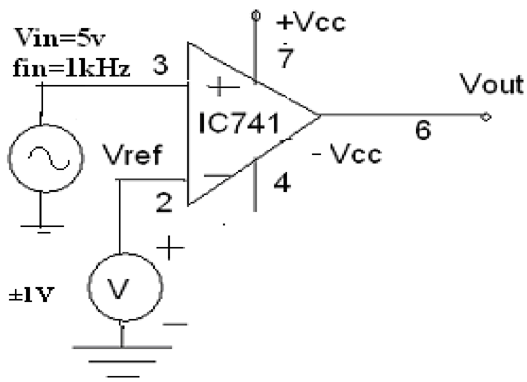
	Amplitude (volts)	Time (ms)
Input		
Output		

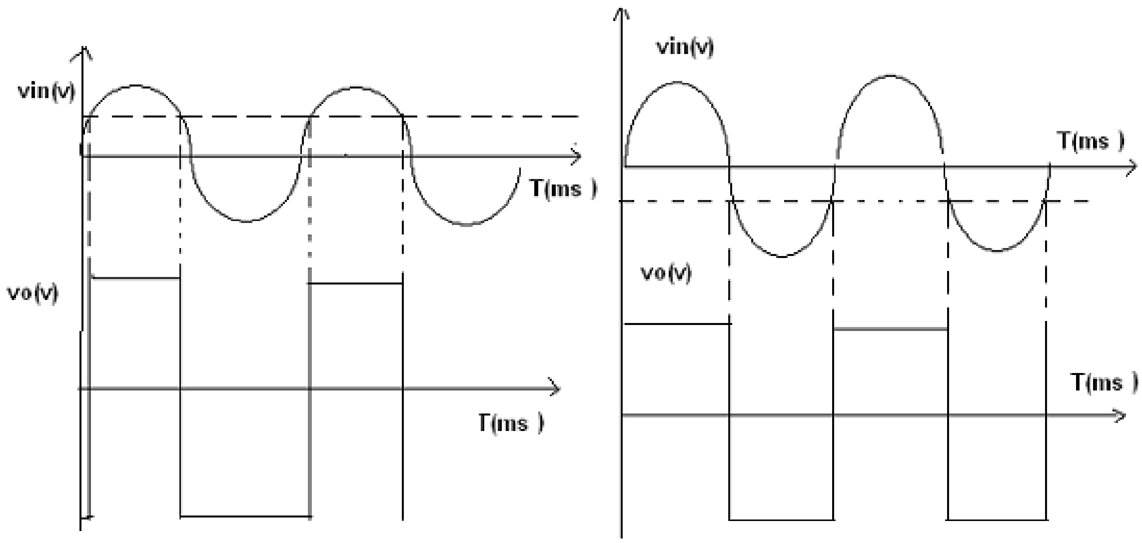
PIN DIAGRAM:



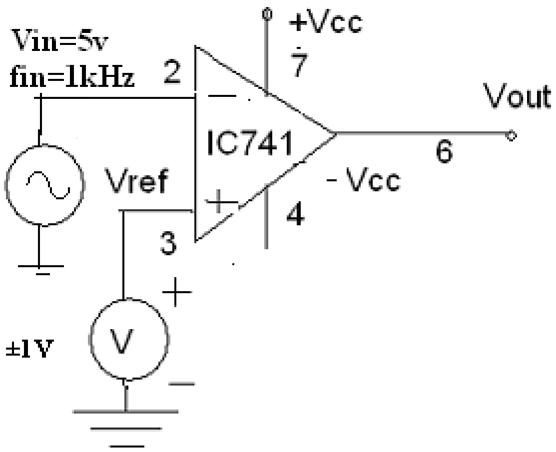
CIRCUIT DIAGRAM:

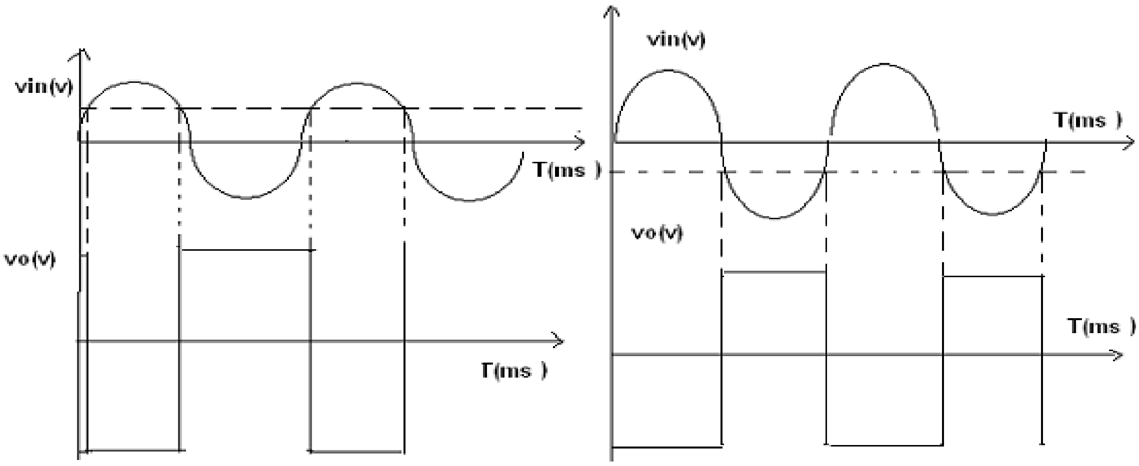
NON INVERTING COMPARATOR





INVERTING COMPARATOR:





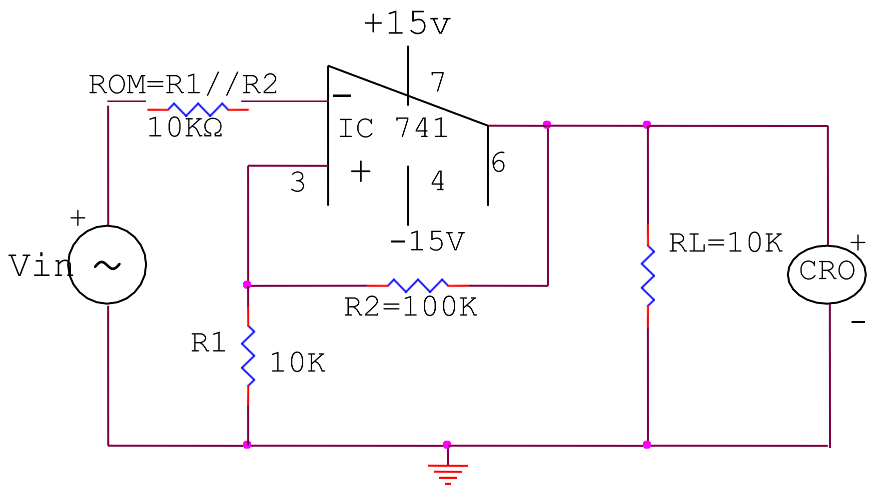
TABULATION:

INPUT VOLTAGEVIN(V)= 5v,1KHz(sin)

Vref	AMPLITUDE(V)	T0N(ms)	TOFF(ms)	T(ms)
	INVERTING COMPARATOR			
	NON- INVERTING COMPARATOR			

SCHMITT TRIGGER:-

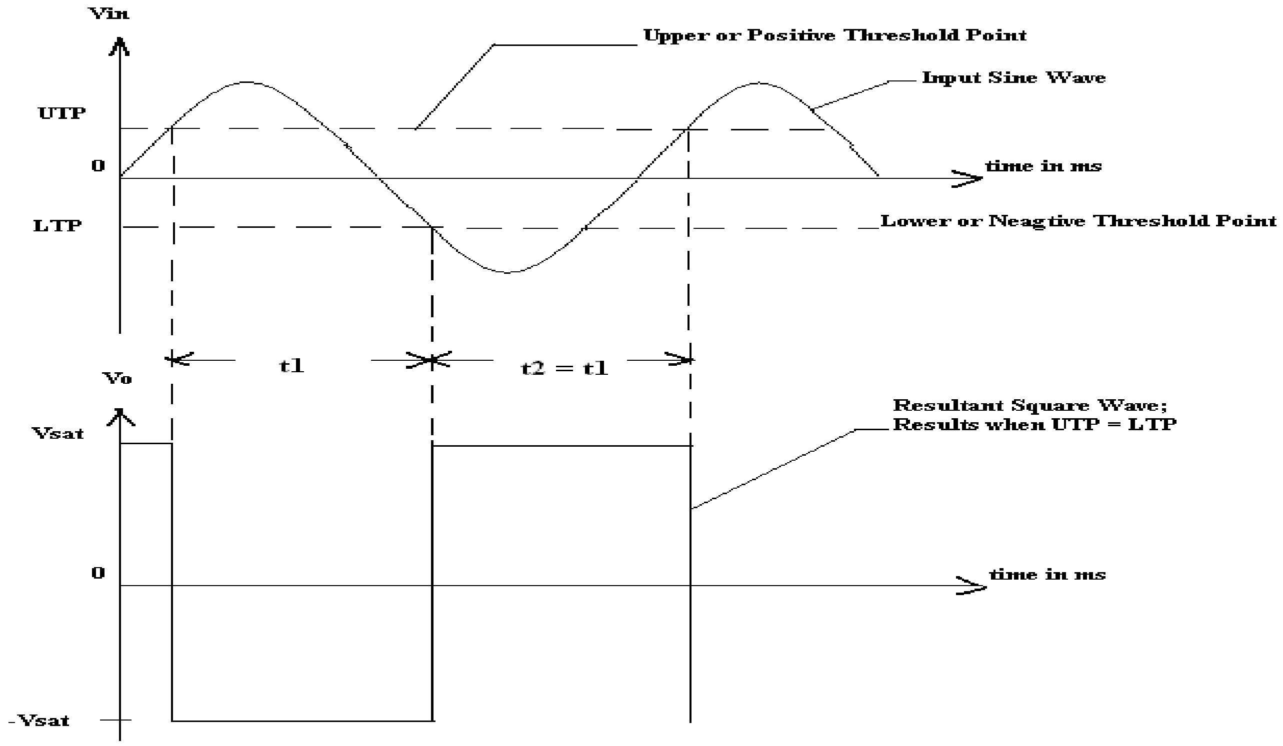
CIRCUIT DIAGRAM:-



TABULATION:

I/P Voltage (Volts)	I/P Time (ms)	VUT (UTP) (Volts)	VLT (LTP) (Volts)	O/P Voltage(ms)	O/P Time (ms)

MODEL GRAPH:



THEORY-(SCHMITT TRIGGER):-

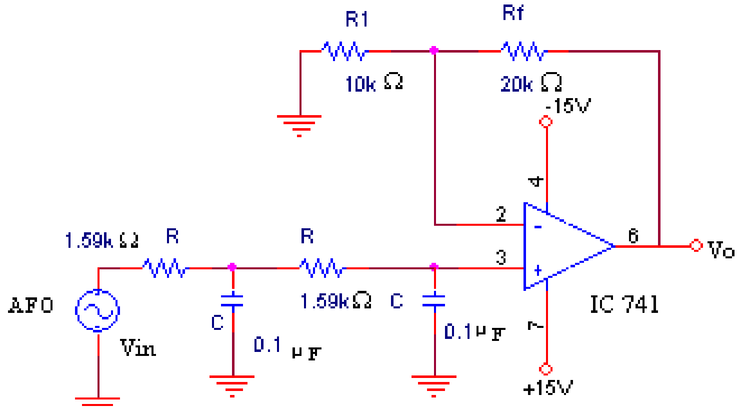
A circuit which converts a irregular shaped waveform to a square waveor pulse is called a Schmitt trigger or squaring circuit. The input voltage Vin triggers the output Vo every time it exceeds certain voltage levels called upper threshold voltage V_{UT} and lower threshold voltage V_{LT}. The threshold voltages are obtained by using the voltage divider. A comparator with positive feedback is said to exhibit hysteresis, a dead band condition. The hysteresis voltage is the difference between V_{UT} & V_{LT}.

There are two types of Schmitt trigger based on where the irregular wave is given. They are, Inverting & non-inverting Schmitt trigger. Schmitt trigger finds application in wave shaping circuits. The other name given to Schmitt trigger is regenerative comparator.

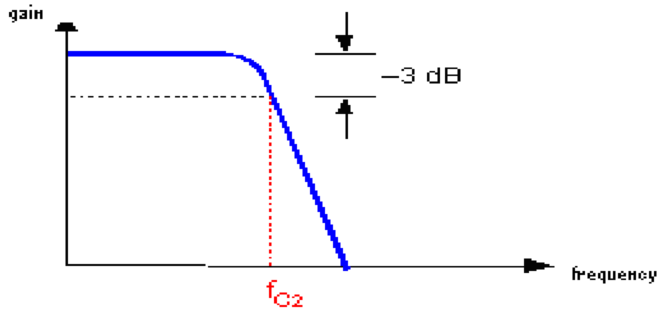
RESULT:

Thus the Integrator, Differentiator and Schmitt Trigger circuit was constructed and the output waveform was noted.

CIRCUIT DIAGRAM:



MODEL GRAPH

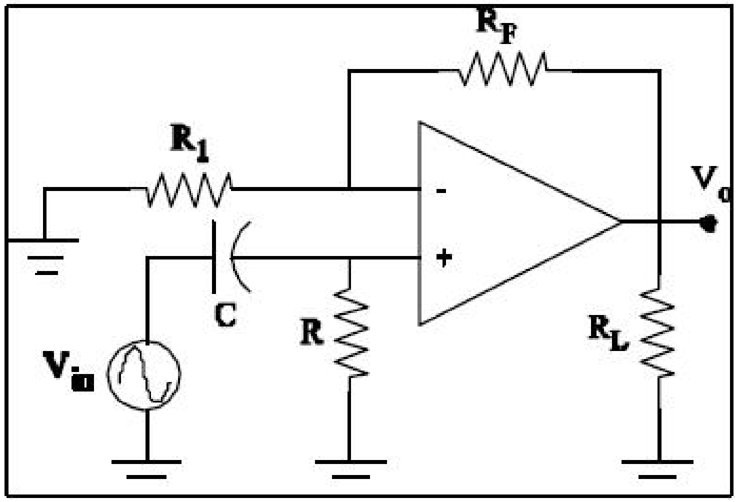


Low-pass filter

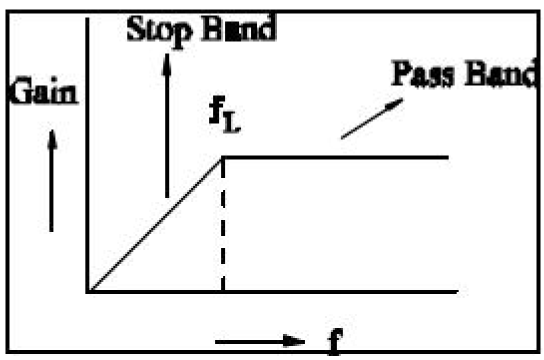
TABULATION

Frequency In Hz	Output Voltage(V_0)	V_0 / V_i	Gain = 20 log (V_0 / V_i)

CIRCUIT DIAGRAM: HIGH PASS FILTER



MODEL GRAPH



TABULATION

Frequency In Hz	Output Voltage(V_0)	V_0 / V_i	Gain = 20 log (V_0 / V_i)

3. ACTIVE LPF AND HPF

AIM:

To Design & Obtain the frequency response of a low pass and high pass filters having cutoff frequency 1 KHz and gain 3.

APPRATUS REQUIRED:

S.No	COMPONENTS	RANGE	QUANTITY
1.	Op –amp	IC 741	1
2.	Resistors	10KΩ, 20 KΩ,1.5 KΩ	1
3.	Capacitor	0.1μf	1
4.	Dual Power supply	0-30v	
5.	Cathode Ray Oscilloscope	(0-30)MHz	1
6.	Bread board		1

THEORY:

A filter is a circuit that is designed to pass a specified band of frequency while attenuating all the signals outside that band. Active filter circuits use the active elements such as op-amps, transistor along the resistors and capacitors. A low pass filter has a constant gain from 0 Hz to a high cutoff frequency. The frequency between 0Hz to f_{c2} are known as pass band frequencies where as the range of frequencies those beyond f_{c2} are attenuated.

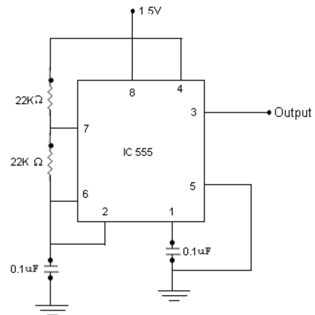
PROCEDURE:

1. Connections are made as per the Circuit diagram.
2. Connect the dual supply voltage of +15V and -15V to bias the Opamp.
3. A Sine wave is given as a input.
4. Vary the frequency, note down the corresponding output voltage.
5. The graph is drawn between the gain (y-axis) and the frequency (x-axis).

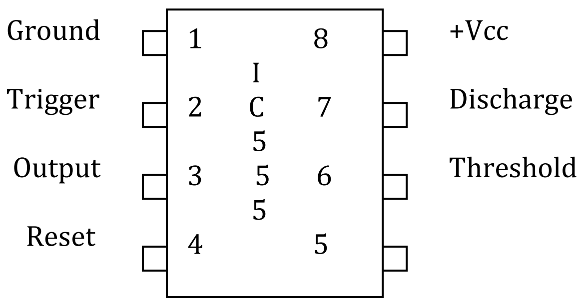
RESULT:

Thus the Low pass and high pass filter circuit was constructed and the output Waveform was noted.

CIRCUIT DIAGRAM



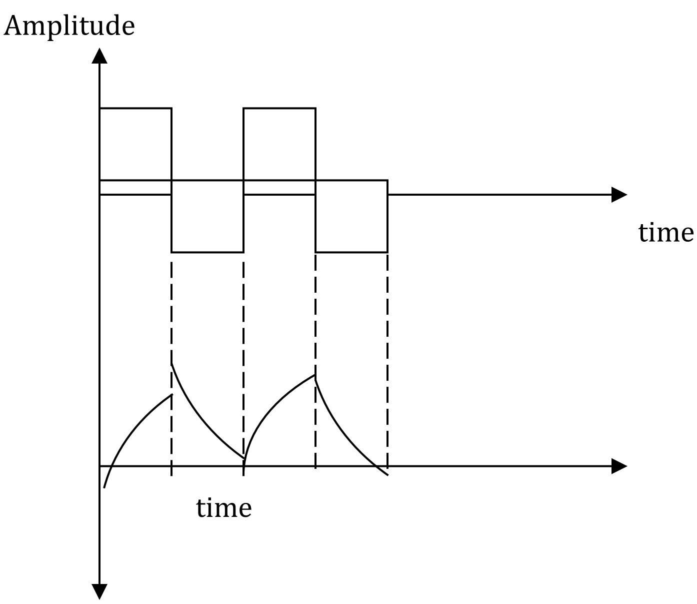
PIN DETAILS



TABULATION

Type	Amplitude	Time period
Square Wave		
Spike Wave		

MODEL GRAPH



4. ASTABLE & MONOSTABLE MULTIVIBRATORUSING IC 555 TIMER

AIM:

To design Astable and monostable multivibrator using IC555.

APPRATUS REQUIRED

S.NO	COMPONENTS	RANGE	QUANTITY
1	IC555	NE555	1
2	Resistor	22KΩ	2
3	Bread board		1
4	Dual power supply	0-30v	1
5	Cathode ray oscilloscope	20MHZ	1

THEORY:

Astable multivibrator has no stable state. Astable multivibrator changes its state alternatively. Hence the operation is also called free running non-sinusoidal oscillator. A stable circuit used to obtain square wave output. The important application of astable multivibrator is voltage controlled oscillator. In a stable multivibrator is a timing circuit whose 'low' and 'high' states are both unstable. As such, the output of an a stable multivibrator toggles between 'low' and 'high' continuously, in effect generating a train of pulses. This circuit is therefore also known as a 'pulse generator' circuit.

The charging time is given by $T1=0.69(Ra+Rb)C$

The discharge time is given by: $T2=0.69Rb\ C$

The total period can therefore be expressed as: $T=.69(Ra+Rb)C$

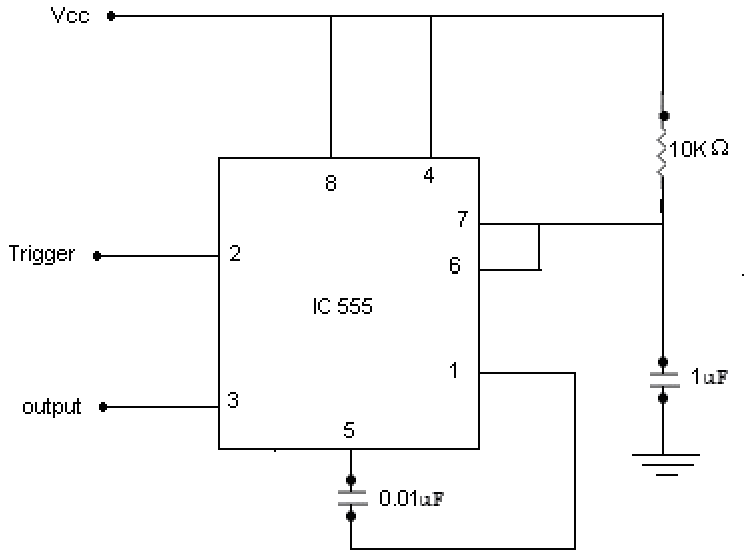
The duty cycle can be derived from T1 and T2 as:

Duty Cycle = (Ra + Rb)/(Ra + 2Rb)

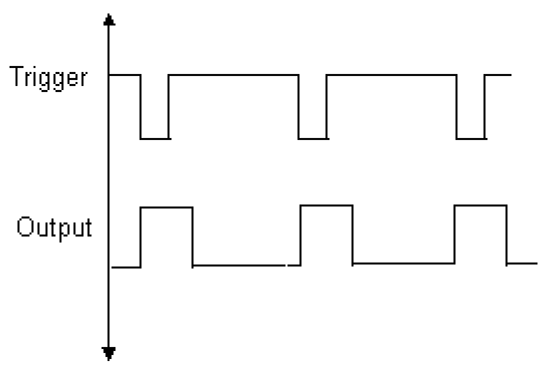
PROCEDURE:

1. Connections are given as per the circuit diagram.
2. Connect the dual supply voltage of -15v and +15v to op-amp
3. using the probes obtain the output from the CRO and compare with the input.
4. Tabulate the voltage and time period.

CIRCUIT DIAGRAM



MODELGRAPH



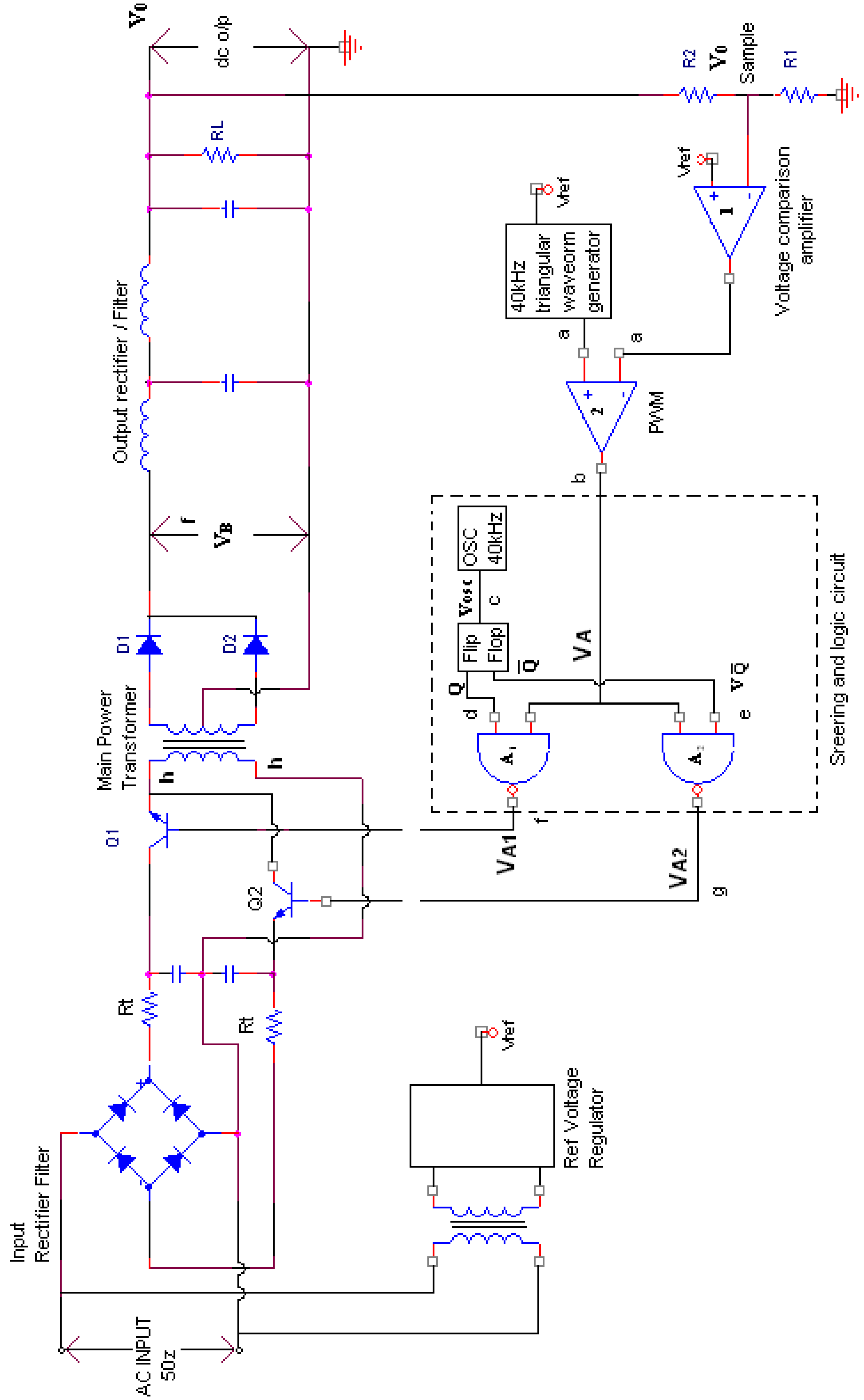
TABULATION:

Type	Amplitude in volts	Time period in ms
Input		
Output		

RESULT:

Thus the Astable and Monostable multivibrator is designed and tested using 555 timer IC

CIRCUIT DIAGRAM:



5 . VOLATAGE REGULATION USING IC 723

AIM :

To study the characteristics of volatage regulation using ic 723

THEORY:

Linear voltage regulator has some limitations. The input step-down transformer is bulky and most expensive. At low frequency large values of filter capacitors are required to decrease the ripple. The input voltage must be greater than the output voltage. So more power dissipated in the active region. SMPS overcomes these difficulties.

The switching regulator is also called as switched mode regulator circuit. It is operated in a different way from that of a conventional series regulator. The pass transistor is used as a controlled switch and is operated in either in cutoff or saturation region. The power dissipation in the transistor is very small. So, the efficiency of switched mode power supply is high.

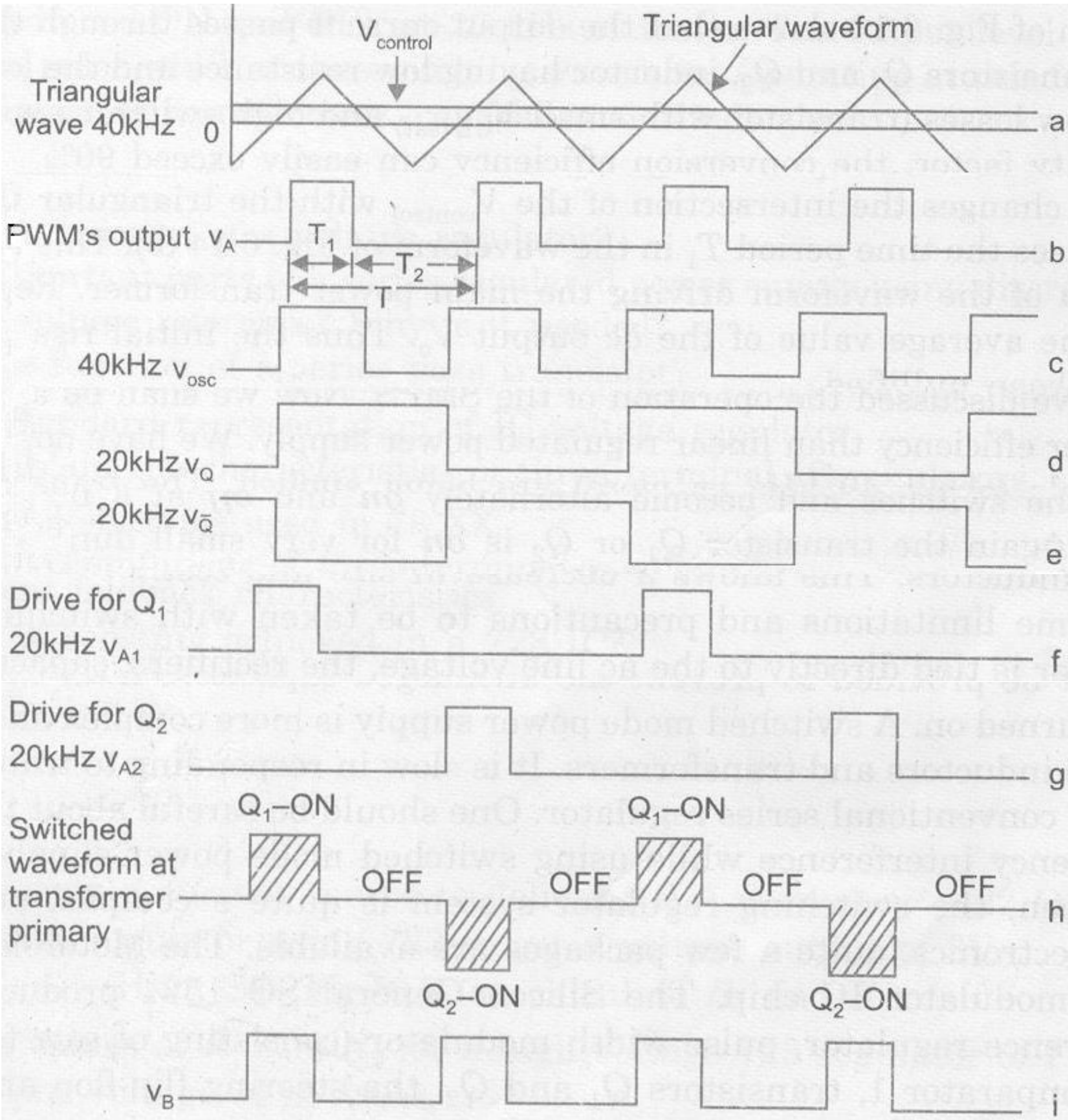
The pulse width modulation is the basic principle of the switching regulators. The average value of a repetitive pulse waveform depends on the area under the waveform.

Depending on the requirements, SMPS are used in the following various applications.

1. Adjustable high voltage constant current sources.
2. Telecommunication systems.
3. Battery powered systems.
4. Personal computers.
5. Video games.
6. Printers.
7. Motor and industrial control systems.
8. Automotive applications.

RESULT:

Thus the characteristics of volatage regulation using ic 723 is studied



Triangular waveform
V control
Triangular wave 40kHz
0
a
PWM's output v A
T 1
T 2
T
b
40kHz v osc
c
20kHz v Q
d
20kHz v Q̄
e
Drive for Q 1
20kHz v A1
f
Drive for Q 2
20kHz v A2
g
Q 1 –ON
Q 1 –ON
Switched waveform at transformer primary
OFF
OFF
OFF
OFF
h
Q 2 –ON
Q 2 –ON
v B
i

REVIEW QUESTIONS

1.What is a voltage regulator ?

2.Define load regulation.

3 Define line regulation.

4.Give the draw back of linear regulator.

5.What are the advantages of IC Voltage regulator.

EX.NO: **Date :**

6. 8086 & 8051 Assembly language program for Arithmetic Operations.

AIM:

To write an ALP to perform Arithmetic operations using 8086 and 8051.

APPARATUS REQUIRED:

1. 8086 kit - 1
2. Power chord - 1
3. Keyboard - 1
4. 8051 kit - 1

i. DOUBLE PRECISION ADDITION:

ALGORITHM:

1. Start the program.
2. Load the addend's value in some address.
3. Load the augend's value in another address
4. Load the LSW of addend in some register
5. Add these values with LSW of the augends.
6. Move this value to a new address denoted as sum and stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
1000			MOV	AX, [1100]	Move data1 to ax
1003			ADD	AX, [1104]	Add data 1 and
1007			MOV	[1200], AX	Move the content
100A			MOV	AX, [1102]	Move the content
100D			ADC	AX, [1106]	Add 1106H
1011			MOV	[1202], AX	Move the AX
1014			LAHF		Load acc content
1015			MOV	[1204], AH	Move AH content
1019			HLT		Stop the program

RESULT OF DOUBLE PRECISION ADDITION:

INPUT:	OUTPUT:
1100H – 12H	1200H – 47H
1101H - 34H	1201H – 41H
1102H – 56H	1202H – C8H
1103H – ABH	1203H - FCH

1104H – 34H, 1105H – 0DH, 1106H – 72H, 1107H – 51H

ii. DOUBLE PRECISION SUBTRACTION:

ALGORITHM:

1. Start the program.
2. Load the minuend's value in some address.
3. Load the subtractend's value in another address
4. Subtract LSW value of AX of minuend.
5. Move the content of this to a new address.
6. Load the MSW of subtractend in AX.
7. Subtract this content with borrow and store in AX.
8. Move to new address formed as 01FFH.
9. Stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
1000			MOV	AX, [1100]	Move data1 to
1003			SUB	AX, [1102]	Add data 1
1007			MOV	[1200], AX	Store the
100A			MOV	AX, [1104]	Move the
100D			SBB	AX, [1100]	Subtract
1011			MOV	[1200], AX	Move AX to
1014			HLT		stop the

RESULT OF DOUBLE PRECISION SUBTRACTION:

INPUT:	OUTPUT:
1100H – 12H	1200H – 23H
1101H - 34H	1201H – 9CH
1102H – 56H	1202H – 1CH
1103H – ABH	1203H – 5AH

1104H – 35H, 1105H – d0H, 1106H – 72H, 1107H – ABH

iii MULTIPLICATION OF 16 BIT NUMBERS:

ALGORITHM:

1. Start the program.
2. Initialize the register for carry and clear HL pair.
3. Load the multiplicand in some register.
4. Load the multiplier in some register.
5. Add the content of stack pointer with HL register pair.
6. If there is carry increment the carry register.
7. Decrement the count.
8. Repeat the above steps until the count becomes zero and stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
1000			MOV	AX, [1100]	Move data1 to
1003			MUL	[1102]	Multiply 1102
1007			MOV	[1200], AX	Move the
100B			MOV	[1202], DX	Move the
100E			HLT		stop the

RESULT OF MULTIPLICATION:

INPUT:	**OUTPUT:**
1100H – 04H	1200H – 06H
1101H - 03H	1201H – 00H
1102H – 01H	1202H – 04H
1103H – 02H	1203H – 06H

iv. DIVISION OF 32 BIT NUMBERS:

ALGORITHM:

1. Start the program.
2. Get the MSW of the dividend in the memory and the LSW in another register.
3. Get the divisor and divide the dividend by divisor.
4. Store the quotient and remainder.
5. Stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
1000			MOV	AX, [1100]	Move data1 to
1004			MOV	BX, [1102]	Move data2 to
1007			DIV	BX	Divide
100B			MOV	[1200], AX	Move the
100E			MOV	[1202], DX	Move the
1012			HLT		Stop the

RESULT OF DIVISION WITHOUT REMAINDER:

INPUT:	**OUTPUT:**
1100H – 10H	1200H – FAH
1101H - 11H	1201H – FFH
1102H – 90H	1202H – 00H
1103H – 99H	1203H – 00H

1104H – 11H, 1105H – 11H

RESULT OF DIVISION WITH REMAINDER:

INPUT:	**OUTPUT:**
1100H – 10H	1200H – FAH
1101H - 11H	1201H – FFH
1102H – 9CH	1202H – 02H
1103H – 99H	1203H – 00H

1104H – 11H, 1105H – 11H

ARITHMETIC OPERATION:

i. 16 BIT ADDITION:

ALGORITHM:

1. Start the program.
2. Get the MSB of 1st and 2nd operands.
3. Add the MSB and store the result in memory
4. Get the LSB of 1st and 2nd operands.
5. Add the LSB of the two operands and store it in memory.

6. Stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMON	OPERAND	COMMENTS
4100			CLR	C	Clear carry
4101			MOV	A, #DATA1	Move data1 to acc
4103			ADD	A, #DATA2	Add data2 with acc
4105			MOV	DPTR, #4150h	Move content in
4108			MOVX	@DPTR, A	Move data to DPTR
4109			INC	DPTR	Increment DPTR
410A			MOV	A, #DATA1	Move data1 to acc
410C			ADDC	A, #DATA2	Add with carry
410E			MOVX	@DPTR, A	Move data to dp
410F			HERE	SJMP: HERE	

RESULT OF 16 BIT ADDITIONS:

INPUT:

4102H – 67H

4104H – 67H

410BH – 67H

OUTPUT:

4150H – ECH

4151H – F7H

ii. 8 BIT SUBTRACTION:

ALGORITHM:

1. Start the program and clear the carry flag and get first operand in accumulator.
2. Set the 2nd operand and subtract it from accumulator.
3. Store the result in memory.
4. Stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
4100			CLR	C	Clear carry
4101			MOV	A, #DATA1	Move data1 to acc
4103			SUBB	A, #DATA2	Add data2 with acc
4105			MOV	DPTR,	Move content in
4108			MOVX	@DPTR, A	Move acc value to
4109			HER	SJMP: HER	

RESULT OF 8 BIT SUBTRACTION WITHOUT CARRY:

INPUT: **OUTPUT:**

4102H=68H **4152H = 10H**

4104H=54H **4153H = 00H**

RESULT OF 8 BIT SUBTRACTIONS WITH CARRY:

INPUT: **OUTPUT:**

4150H= 57H 4152H = F1H

4151H= 66H 4153H = F9H(C)

iii. 8 BIT MULTIPLICATION:

ALGORITHM:

1. Start the program.
2. Get 1st operand in A and 2nd in B.
3. Multiply A and B contents using multiplication instruction.
4. Store the result in memory.
5. Stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
4100			MOV	A, #DATA1	Move data1 to acc
4102			MOV	B, #DATA1	Move data1 to acc
4105			MUL	AB	Add data2 with acc
4106			MOV	DPTR,	Move content in
4109			MOVX	@DPTR, A	Move acc value to
410A			INC	DPTR	INC DPTR
410B			MOV	A, B	Move B register
410D			MOVX	@DPTR, A	Move acc value to
410E			HER	SJMP: HER	

RESULT OF 8 BIT MULTIPLICATIONS:

INPUT: **OUTPUT:**

4101H=0AH

4500H = 50H

4104H=88H

4501H = 05H

iv. 8 BIT DIVISION:

ALGORITHM:

1. Start the program.
2. Get 1st operand in A and 2nd in B.
3. Divide A by B contents using division instruction.
4. Store the result in memory.
5. Stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
4100			MOV	A, #DATA1	Move data1 to acc
4102			MOV	B, #DATA1	Move data1 to acc
4105			DIV	AB	Divide A by B
4106			MOV	DPTR,	Move content in
4109			MOVX	@DPTR, A	Move acc value to
410A			INC	DPTR	Inc DPTR

410B			MOV	A, B	Move B register
410D			MOVX	@DPTR, A	Move acc value to
410E			HER	SJMP: HER	

RESULT OF 8 BIT DIVISION WITHOUT REMAINDER:

INPUT: **OUTPUT:**

4101H=53H **4500H = 02H**

4103H=23H **4501H = 10H**

RESULT OF 8 BIT DIVISIONS WITH REMAINDER:

INPUT: **OUTPUT:**

4101H=06H

4500H = 02H

4103H=03H

RESULT:

6. 8051 Assembly language program for Logical, Interrupt & UART Operations.

AIM:

To write an assembly language program for the Logical, Interrupt & UART Operations using 8051.

APPARATUS REQUIRED:

1. 8051 kit - 1
2. Power chord - 1
3. Keyboard - 1

LOGICAL OPERATION:

i. OR OPERATION:

ALGORITHM:

1. Start the program.
2. Get 1st operand in Accumulator.
3. Get 2nd operand and OR it with accumulator content.
4. Store the result in memory.
5. Stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
4100			MOV	A, #DATA1	Move data1 to acc
4101			ORL	A, #DATA2	Add data2 with acc
4103			MOV	DPTR,	Move content in
4105			MOVX	@DPTR, A	Move acc value to
4108			HER	SJMP: HER	

RESULT OF OR OPERATION:

INPUT: **OUTPUT:**

4101H=79H

4500H = FDH

4103H=ACH

ii. AND OPERATION:

ALGORITHM:

1. Start the program.
2. Get 1st operand in Accumulator.
3. Get 2nd operand and AND it with accumulator content.
4. Store the result in memory.
5. Stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
4100			MOV	A, #DATA1	Move data1 to acc
4101			ANL	A, #DATA2	Add data2 with acc
4103			MOV	DPTR,	Move content in
4105			MOVX	@DPTR, A	Move acc value to
4108			HER	SJMP: HER	

RESULT OF AND OPERATION:

INPUT: **OUTPUT:**

4101H=56H

4500H = 42H

4103H=E3H

RESULT:

i. XOR OPERATION:

ALGORITHM:

1. Start the program.
2. Get 1st operand in Accumulator.
3. Get 2nd operand and XOR it with accumulator content.
4. Store the result in memory.
5. Stop the program.

PROGRAM:

ADDRESS	LABEL	OPCODE	MNEMONICS	OPERAND	COMMENTS
4100			MOV	A, #DATA1	Move data1 to acc
4101			XRL	A, #DATA2	Exclusive or data2
4103			MOV	DPTR,	Move content in
4105			MOVX	@DPTR, A	Move acc value to
4108			HER	SJMP: HER	

RESULT OF OR OPERATION:

INPUT: **OUTPUT:**

4101H=79H 4500H = FDH

4103H=ACH

INTERRUPT:

Algorithm:

1. Move the value 081H to the Interrupt Enable pin to enable it.
2. Press INT0 interrupt is enabled. LED's are on.
3. End the Program.

PROGRAM:

Memory Location	Label	Opcode	Mnemonics	Comments
4100			MOV IE, #081H	EXT0 Interrupt is enabled
4103			JB TCON.1, LOOP1	
4106			MOV P1, #00H	
4109	LOOP1		JNB TCON.1, LOOP2	
410C			MOV P1, #0FFH	
410F	LOOP2		RET1	
4110			SJMP 4110	

Result:

8. Interfacing DAC to Microcontroller and generate Square, Triangular and Saw –tooth waveforms.

AIM:

To interface DAC with 8051 to demonstrate the generation of square, saw tooth and triangular wave.

APPARATUS REQUIRED:

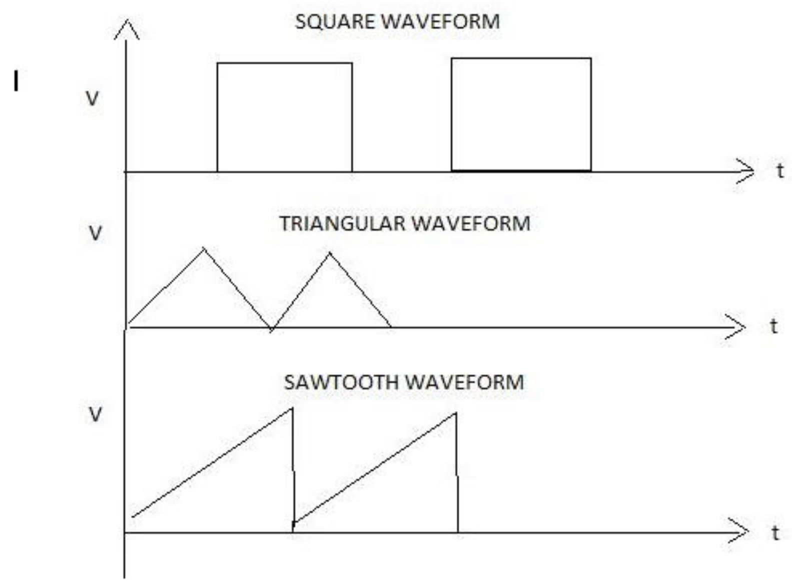
SL.NO	ITEM	SPECIFICATION	QUANTITY
1	Microprocessor kit	4185,Vi Microsystems	1
2	Power supply	+5 V dc	1
3	DAC Interface board	Vi Microsystems	1

ALGORITHM:

(a) SQUARE WAVE GENERATION:

1. Load the initial value (00) to Accumulator and move it to DAC.
2. Call the delay program
3. Load the final value (FF) to accumulator and move it to DAC.
4. Call the delay program.
5. Repeat steps 2 to 5.

WAVEFORM



OBSERVATION:

WAVE FORMS	AMPLITUDE	TIME PERIOD
Square waveform		
Saw tooth waveform		
Triangular waveform		

Program:

ADDRESS	LABEL	MNEMON ICS	OPCODE	OPERAND	COMMENT
		MOV DPTR,#FFC8			
	START	MOV A,#00			
		MOVX @DPTR,A			
		LCALL DELAY			
		MOV A,# FF			
		MOVX @DPTR,A			
		LCALL DELAY			
		LJMP START			
	DELAY	MOV R1,#05			
	LOO[P	MOV R2,#FF			
		DJNZ R2,HERE			
		DJNZ R1,LOOP			
		RET			
		SJMP START			

(b) SAW TOOTH GENERATION

1. Load the initial value (00) to Accumulator
2. Move the accumulator content to DAC.
3. Increment the accumulator content by 1.
4. Repeat steps 3 and 4.

ADDRESS	LABEL	MNEMON ICS	OPCODE	OPERAND	COMMENT
		MOV DPTR,#FFC0			
		MOV A,#00			
	LOOP	MOVX @DPTR,A			
		INC A			
		SJMP LOOP			

(c) TRIANGULAR WAVE GENERATION

1. Load the initial value (00) to Accumulator.
2. Move the accumulator content to DAC
3. Increment the accumulator content by 1.
4. If accumulator content is zero proceed to next step. Else go to step 3.
5. Load value (FF) to accumulator.
6. Move the accumulator content to DAC.
7. Decrement the accumulator content by 1.
8. If accumulator content is zero go to step 2. Else go to step 2.

ADDRESS	LABEL	MNEMON ICS	OPCODE	OPERAND	COMMENT
		MOV DPTR,#FFC8			
	START	MOV A,#00			
	LOOP1	MOVX @DPTR,A			
		INC A			
		JNZ LOOP1			
		MOV A,#FF			
	LOOP2	MOVX @DPTR,A			
		DEC A			
		JNZ LOOP2			
		LJMP START			

Result:

Thus the square, triangular and saw tooth wave form were generated by interfacing DAC with 8051 trainer kit.

9. Interfacing ADC to Microcontroller.

AIM:

To interface a ADC with 8051 microcontroller and operate it.

APPARATUS REQUIRED:

SL.NO	ITEM	SPECIFICATION	QUANTITY
1	Microcontroller kit	8051,Vi Microsystems	1
2	Power supply	+5 V dc	1
3	ADC Interface board	Vi Microsystems	1

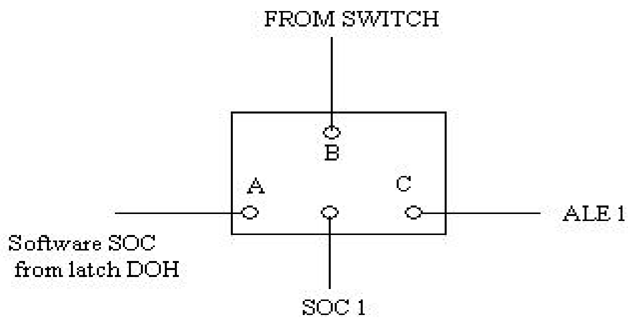
ALGORITHM:

1. Select the channel and latch the address.
2. Send the start conversion pulse.
3. Read EOC signal.
4. If EOC =1 continue else go to step (3)
5. Read the digital output.
6. Store it in a memory location.

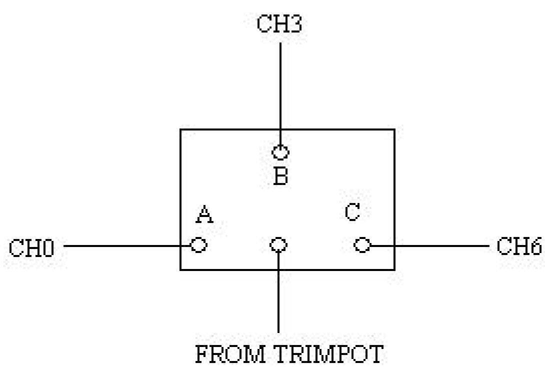
PROGRAM:

Label	Program	Comments
	MOV DPTR, #FFC8	
	MOV A,#10	Select Channel 0 and make ALE Low
	MOVX @DPTR, A	
	MOV A,#18	make ALE High
	MOVX @DPTR, A	
	MOV DPTR, #FFD0	
	MOV A,#01	SOC signal High
	MOVX @DPTR, A	
	MOV A,#00	SOC signal low
	MOVX @DPTR, A	
	MOV DPTR, #FFD8	
WAIT	MOVX A,@DPTR	
	JNB E0,WAIT	Check for EOC
	MOV DPTR,#FFC0	Read ADC data
	MOVX A,@DPTR	
	MOV DPTR,#4150	Store the data in memory location
	MOVX @DPTR, A	
HERE	SJMP HERE	

J2: (SOC jumper selection for ch0 – ch7)



J5: (Provision to connect the on board trim pot to any of the below mentioned channels)



OBSERVATION

ANALOG VOLTAGE	DIGITAL DATA ON LED DISPLAY	HEX CODE IN LOCATION 4150

RESULT:

10. Interfacing Stepper Motor to 8051 and operate it in Clockwise and Anti-Clockwise directions.

AIM:

To interface a stepper motor with 8051 microcontroller and operate it.

THEORY:

A motor in which the rotor is able to assume only discrete stationary angular position is a stepper motor. The rotary motion occurs in a step-wise manner from one equilibrium position to the next. Stepper Motors are used very wisely in position control systems like printers, disk drives, process control machine tools, etc.

The basic two-phase stepper motor consists of two pairs of stator poles. Each of the four poles has its own winding. The excitation of any one winding generates a North Pole. A South Pole gets induced at the diametrically opposite side. The rotor magnetic system has two end faces. It is a permanent magnet with one face as South Pole and the other as North Pole.

The Stepper Motor windings A1, A2, B1, B2 are cyclically excited with a DC current to run the motor in clockwise direction. By reversing the phase sequence as A1, B2, A2, B1, anticlockwise stepping can be obtained.

2-PHASE SWITCHING SCHEME:

In this scheme, any two adjacent stator windings are energized. The switching scheme is shown in the table given below. This scheme produces more torque.

ANTICLOCKWISE						CLOCKWISE					
STEP	**A1**	**A2**	**B1**	**B2**	**DATA**	**STEP**	**A1**	**A2**	**B1**	**B2**	**DATA**
1	1	0	0	1	9h	1	1	0	1	0	Ah
2	0	1	0	1	5h	2	0	1	1	0	6h
3	0	1	1	0	6h	3	0	1	0	1	5h
4	1	0	1	0	Ah	4	1	0	0	1	9h

ADDRESS DECODING LOGIC:

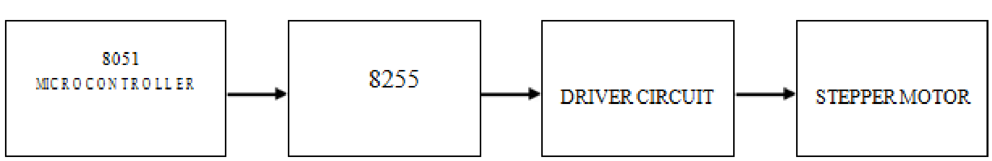
The 74138 chip is used for generating the address decoding logic to generate the device select pulses, CS1 & CS2 for selecting the IC 74175.The 74175 latches the data bus to the stepper motor driving circuitry.

Stepper Motor requires logic signals of relatively high power. Therefore, the interface circuitry that generates the driving pulses use silicon Darlington pair transistors. The inputs for the interface circuit are TTL pulses generated under software control using the Microcontroller Kit. The TTL levels of pulse sequence from the data bus are translated to high voltage output pulses using a buffer 7407 with open collector.

PROCEDURE:

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

BLOCK DIAGRAM:



Address	OPCODES	Label	MNEMONICS	OPERAND	Comments
			ORG	4100h	
4100		START	MOV	DPTR, #TABLE	Load the start address of switching scheme data TABLE into Data Pointer (DPTR)
4103			MOV	R0, #04	Load the count in R0
4105		LOOP:	MOVX	A, @DPTR	Load the number in TABLE into A
4106			PUSH	DPH	Push DPTR value to Stack
4108			PUSH	DPL	
410A			MOV	DPTR, #0FFC0h	Load the Motor port address into DPTR
410D			MOVX	@DPTR, A	Send the value in A to stepper Motor port address
410E			MOV	R4, #0FFh	Delay loop to cause a specific amount of time delay before next data item is sent to the Motor
4110		DELAY:	MOV	R5, #0FFh	
4112		DELAY1:	DJNZ	R5, DELAY1	
4114			DJNZ	R4, DELAY	
4116			POP	DPL	POP back DPTR value from Stack
4118			POP	DPH	
411A			INC	DPTR	Increment DPTR to point to next item in the table
411B			DJNZ	R0, LOOP	Decrement R0, if not zero repeat the loop
411D			SJMP	START	Short jump to Start of the program to make the motor rotate continuously
411F		TABLE:	DB	09 05 06 0Ah	Values as per two-phase switching scheme

RESULT:

Thus a stepper motor was interfaced with 8051 and run in forward and reverse directions at various speeds.