Experiment 1: Measurement of AC and DC voltage using Multimeter and CRO

Aim: (i) To measure AC and DC voltage using Multi-meter & Cathode Ray Oscilloscope (CRO)

(ii) To measure frequency of the AC signal using CRO

Apparatus required: Signal Generator, Variable DC supply, Multi-meter and CRO.

Procedure:

(i) To measure DC/AC voltage Using Digital Multi-meter (DMM)

1. Connect the black test lead to COM terminal and RED terminal to V/Ω terminal.
2. Switch on the Variable Dc supply set to 1V
3. Set the range selector switch to DC range and connect the test leads across the variable DC supply.
4. Vary the supply voltage and observe the variation in Multi-meter.
5. Set the range selector switch to AC range and connect the test leads across the Signal generator.
6. Switch on the signal generator and initially set the voltage knob of signal generator to minimum.
7. Vary the voltage and measure the voltage on the Multi-meter.
8. Multimeter reads the RMs voltage of the signal generator = $V_{p-p}/2\sqrt{2}$.
9. Tabulate both DC and AC Voltages.

(ii) To measure DC/AC voltage Using Cathode Ray Oscilloscope:

1. Switch on the CRO obtain a defined Trace of a horizontal line on the screen by adjusting INTENS and FOCUS knob
2. Adjust the Y position knob to make the trace to coincide with the centre line on the screen by keeping the AC/DC switch in GND Position.
3. Release the switch from GND position and observe a horizontal trace on CRO.
4. To measure DC voltage, Keep the Switch in DC position and Connect the Variable DC supply to either of the Channel using a probe..
5. Measure the shift in trace from the original position.
6. Multiply this by the scale indicated by the vol/div knob this gives the DC voltage.
7. To measure the Ac voltage, connect the Signal generator to either of the channel using the probe and by keeping the Switch in AC position.
10. Observe the signal in the CRO, measure the number of divisions from peak to peak. Multiply this by the volt/div knob. RMs voltage of the signal generator = $V_{p-p}/2\sqrt{2}$.

(iii) To measure the frequency of signal.

1. To measure the frequency, Keep the Switch in AC position and connect the Signal generator to either of the channel using the probe.
2. Adjust Time/Div knob so as to see two three cycles on the CRO
3. Count the number of divisions in one cycle of the waveform. Multiply this by the time/div knob this gives the time period of the signal.
4. Reciprocal of the time period will give the frequency of signal.
5. Match the frequency on the signal generator with the measured value.

Tabulation:

(i) DC voltage using DMM and CRO:

Sl.No	CRO			Measured voltage by DMM
	Shift in division	Volts/div	Measure DC voltage Vdc = Shift in division **X** volts/div	
1				
2				
3				
4				
5				

(ii) AC voltage using DMM and CRO:

Sl.No	CRO			RMS voltage = Vp-p/2√2	Measured voltage by DMM
	Peak to peak in Division Vp-p	Volts/div	AC voltage **Vac= =** Vp-p **X** volts/div		
1					
2					
3					
4					
5					

(iii) Frequency using CRO:

Sl.No	No of divisions/cycle (X-axis)	Time/div	Time period (T) T= No of divisions **X** Time/div	Frequency f=1/T (hertz)	Frequency on function generator
1					
2					
3					
4					
5					

Experiment 2: To Determine Efficiency of Half wave rectifier Using Pspice Simulation.

Aim: To find ripple factor and efficiency of Half wave rectifier.

Tool used: Pspice

Apparatus required: Signal Generator, Transformer, Multi-meter and CRO.

Components required: Diode and Resistor.

Procedure:

i. Select the required apparatus and components from the library and place on the work bench.
ii. Connect the circuit half wave Rectifier as shown in the figure using probes.
iii. Set the input voltage Vac=220V
iv. Keep the Load Resistance R_L=100Ω and note down the output ac voltage Vac and dc voltages V_{dc} i.e V_{OUT} .
v. Multiply ac voltage Vac by √2 to get peak value and calculate theoretical value $V_{dc}= V_{max}/\pi$. Compare the value with the practical dc value V_{dc}
vi. Calculate the ripple factor and rectification Efficiency.
vii. Repeat the above steps for R_L= 500Ω and 1KΩ.
viii. Observe the input and output waveforms on the scope.

Tabulation:

Input Voltage V_{ac}= _________ V

Sl. No	Load R_L (kΩ)	Output Voltage			Ripple Factor r	Efficiency η (%)
		V_{ac} (Volt)	V_{dc} (Volt)	V_{max}/π (Volt)		
1						
2						
3						

$$V_{dc} = \frac{V_{max}}{\pi} = 0.318V_{max}$$

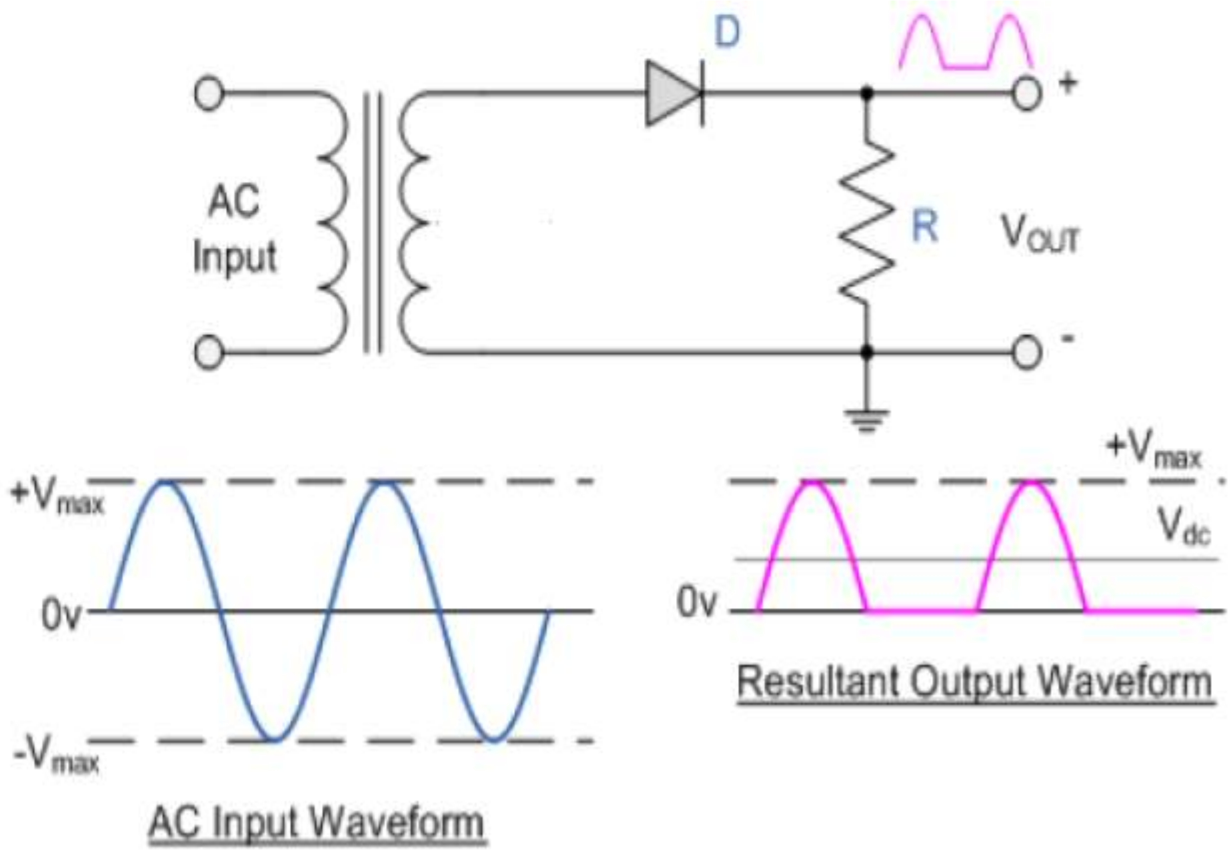
$$I_{dc} = \frac{V_{dc}}{R}$$

$$P = I_{dc}^{\ 2}R.$$

$$r = \frac{V_{ac}(output)}{V_{dc}(output)}$$

Rectification Efficiency $\eta = P_{dc}/P_{ac}$

Circuit Diagram:



Experiment 3: Verification of Logic Gates and Half Adder

Aim: To study and verify the truth table of logic gates and verify the Half adder

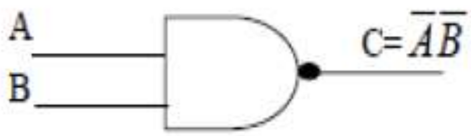
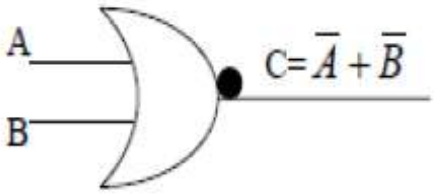
Apparatus required: Trainer Kit

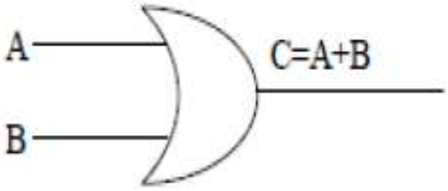
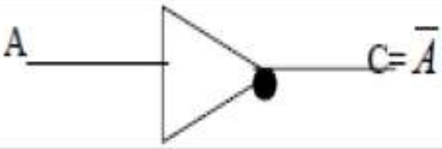
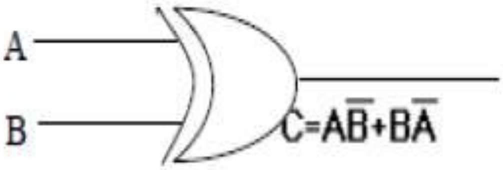
Components: IC 7408, IC 7400.IC 7432, IC 7406, IC 7402, IC7404 and IC 7486

Procedure:

i. Check the Components
ii. Insert the Appropriate IC in trainer kit
iii. Make the connections as per the pin diagram.
iv. Provide the input through switches and observe the output on the LED’s
v. Verify the Truth table for all the IC
vi. Rig up the circuit for Half adder as shown in the figure
vii. Verify the truth table for Half adder

(i)Verification of basic gates

<table>
<tr><th rowspan="2">S.NO</th><th rowspan="2">GATE</th><th rowspan="2">SYMBOL</th><th colspan="2">INPUTS</th><th>OUTPUT</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td rowspan="4">1.</td><td rowspan="4">NAND IC 7400</td><td rowspan="4">
</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
<tr><td rowspan="4">2.</td><td rowspan="4">NOR IC 7402</td><td rowspan="4">
</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
<tr><td rowspan="4">3.</td><td rowspan="4">AND IC 7408</td><td rowspan="4">
</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
</table>

4.	OR IC 7432		0	0	0
			0	1	1
			1	0	1
			1	1	1
5.	NOT IC 7404		1	-	0
			0	-	1
6.	EX-OR IC 7486		0	0	0
			0	1	1
			1	0	1
			1	1	0

(ii) HALF ADDER

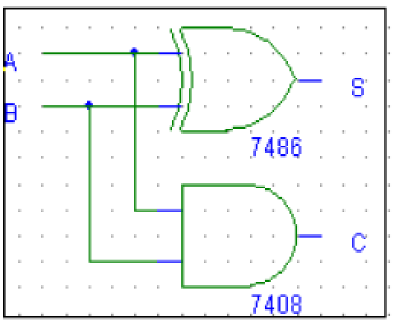
TRUTH TABLE

INPUTS		OUTPUTS	
A	**B**	**S**	**C**
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

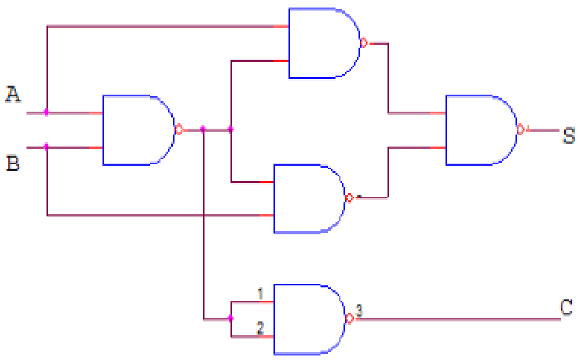
BOOLEAN EXPRESSIONS:

S=A $\oplus$ B
C=A B

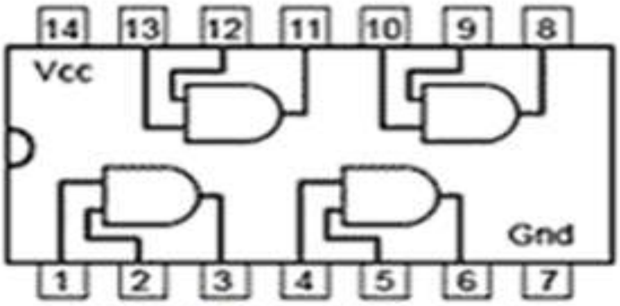
i) Basic Gates



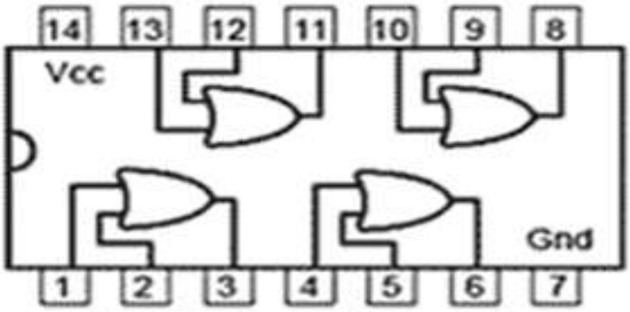
ii) NAND Gates



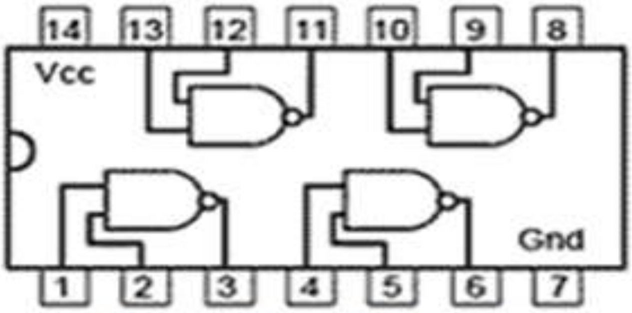
Pin diagram:



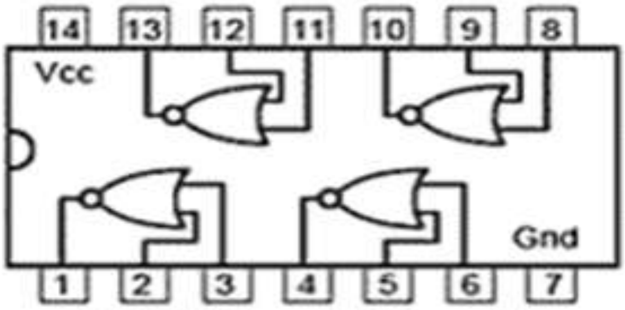
7408 Quad 2 input
AND Gates



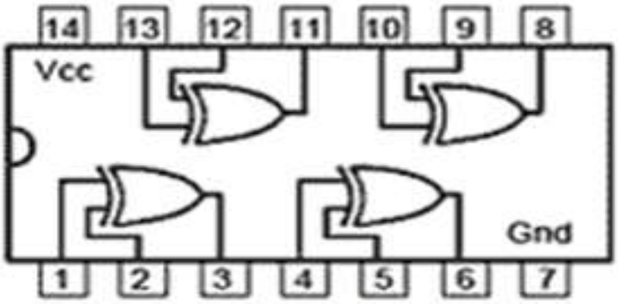
7432 Quad 2 input
OR Gates



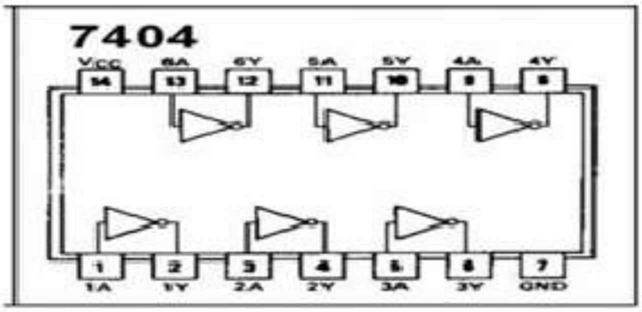
7400 Quad 2 input
NAND Gates



7402 Quad 2 input
NOR Gates



7486 Quad 2 input
XOR Gates



Experiment 4: Simulation of Modulation Techniques: AM and FM

Aim: To modulate the message using AM and FM Techniques

Simulation Tool: Matlab

Procedure:

(i) Open the MATLAB

(ii) Create a new .m file

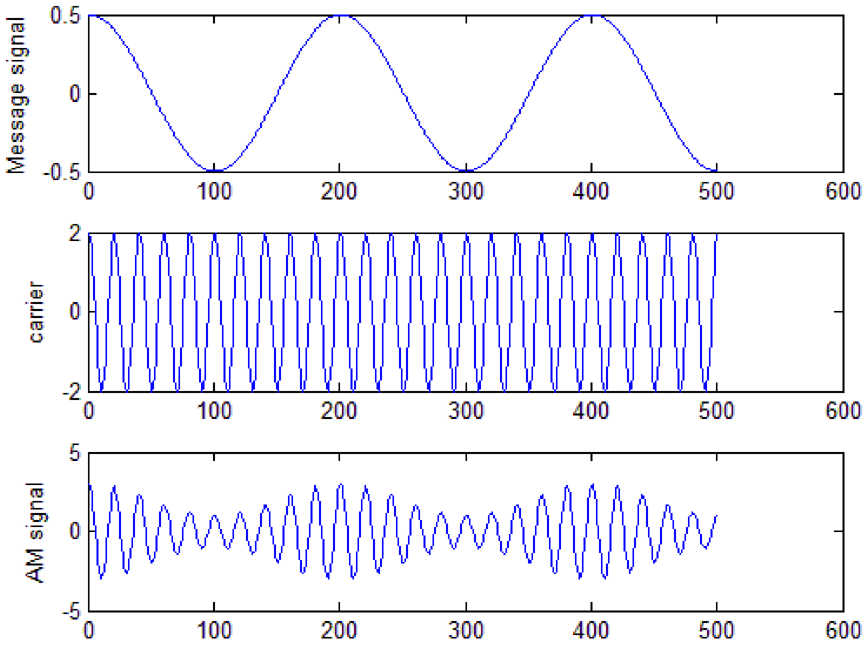
(iii) Type AM program and run the program .observe the output in the figure window

(iv) Type FM Program, provide the required input and run the program. Observe the output in the figure window.

Program:

AM:

```
clc;
clear all;
close all;
Ac=2; %carrier amplitude
fc=0.5; %carrier frequency
Am=.5; %message signal amplitude
fm=.05; %message signal frequency
Fs=100; %sampling rate/frequency
ka=1;%Amplitude Sensitivity
t=[0:0.1:50];%defining the time range & disseminating it into samples
ct=Ac*cos(2*pi*fc*t); %defining the carrier signal wave
mt=Am*cos(2*pi*fm*t); %defining the message signal
AM=ct.*(1+ka*mt); %Amplitude Modulated wave, according to the standard definition
subplot(3,1,1);%plotting the message signal wave
plot(mt);
ylabel('Message signal');
subplot(3,1,2); %plotting the carrier signal wave
plot(ct);
ylabel('carrier');
subplot(3,1,3); %plotting the amplitude modulated wave
plot(AM);
ylabel('AM signal');
```



<u>FM:</u>

```
clc
clear all
close all
t = 0:0.001:1; %upto 1000 samples
vm = input('Enter Amplitude (Message) = ');
vc = input('Enter Amplitude (Carrier) = ');
fM = input('Enter Message frequency = ');
fc = input('Enter Carrier frequency = ');
m = input('Enter Modulation Index = ');
msg = vm*sin(2*pi*fM*t);
subplot(3,1,1); %plotting message signal
plot(t,msg);
xlabel('Time');
ylabel('Amplitude');
title('Message ');
carrier = vc*sin(2*pi*fc*t);
subplot(3,1,2); %plotting carrier signal
plot(t,carrier);
xlabel('Time');
ylabel('Amplitude');
title('Carrier Signal');
y = vc*sin(2*pi*fc*t+m.*cos(2*pi*fM*t));
subplot(3,1,3);%plotting FM (Frequency Modulated) signal
plot(t,y);
xlabel('Time');
ylabel('Amplitude');
title('FM Signal');
```

MATLAB Input:

Enter Amplitude (Message) = 5
Enter Amplitude (Carrier) = 5
Enter Message frequency = 8
Enter Carrier frequency = 100
Enter Modulation Index = 10