

INSTRUMENTATION LABORATORY

LAB MANUAL

Academic Year : 2019 - 2020
Course Code : AEC109
Regulations : IARE - R16
Class : VI Semester (ECE)

Prepared by

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Assistant Professor



Department of Electronics & Communication Engineering
INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal – 500 043, Hyderabad



INSTITUTE OF AERONAUTICAL ENGINEERING

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Dundigal, Hyderabad - 500 043

Electronics & Communication Engineering

Vision

To produce professionally competent Electronics and Communication Engineers capable of effectively and efficiently addressing the technical challenges with social responsibility.

Mission

The mission of the Department is to provide an academic environment that will ensure high quality education, training and research by keeping the students abreast of latest developments in the field of Electronics and Communication Engineering aimed at promoting employability, leadership qualities with humanity, ethics, research aptitude and team spirit.

Quality Policy

Our policy is to nurture and build diligent and dedicated community of engineers providing a professional and unprejudiced environment, thus justifying the purpose of teaching and satisfying the stake holders.

A team of well qualified and experienced professionals ensure quality education with its practical application in all areas of the Institute.

Philosophy

The essence of learning lies in pursuing the truth that liberates one from the darkness of ignorance and Institute of Aeronautical Engineering firmly believes that education is for liberation.

Contained therein is the notion that engineering education includes all fields of science that plays a pivotal role in the development of world-wide community contributing to the progress of civilization. This institute, adhering to the above understanding, is committed to the development of science and technology in congruence with the natural environs. It lays great emphasis on intensive research and education that blends professional skills and high moral standards with a sense of individuality and humanity. We thus promote ties with local communities and encourage transnational interactions in order to be socially accountable. This accelerates the process of transfiguring the students into complete human beings making the learning process relevant to life, instilling in them a sense of courtesy and responsibility.



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Electronics & Communication Engineering

Program Outcomes	
PO1	Engineering knowledge: An ability to apply knowledge of basic sciences, mathematical skills, engineering and technology to solve complex electronics and communication engineering problems (Fundamental Engineering Analysis Skills).
PO2	Problem analysis: An ability to identify, formulate and analyze engineering problems using knowledge of Basic Mathematics and Engineering Sciences. (Engineering Problem Solving Skills).
PO3	Design/development of solutions: An ability to provide solution and to design Electronics and Communication Systems as per social needs(Social Awareness)
PO4	Conduct investigations of complex problems: An ability to investigate the problems in Electronics and Communication field and develop suitable solutions (Creative Skills).
PO5	Modern tool usage An ability to use latest hardware and software tools to solve complex engineering problems (Software and Hardware Interface).
PO6	The engineer and society: An ability to apply knowledge of contemporary issues like health, Safety and legal which influences engineering design (Social Awareness).
PO7	Environment and sustainability An ability to have awareness on society and environment for sustainable solutions to Electronics & Communication Engineering problems(Social awareness).
PO8	Ethics: An ability to demonstrate understanding of professional and ethical responsibilities(Engineering impact assessment skills).
PO9	Individual and team work: An ability to work efficiently as an individual and in multidisciplinary teams(Team Work).
PO10	Communication: An ability to communicate effectively and efficiently both in verbal and written form(Communication Skills).
PO11	Project management and finance: An ability to develop confidence to pursue higher education and for life-long learning(Continuing education awareness).
PO12	Life-long learning: An ability to design, implement and manage the electronic projects for real world applications with optimum financial resources(Practical engineering analysis skills).
Program Specific Outcomes	
PSO1	Professional Skills: An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.
PSO2	Problem-solving skills: An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.
PSO3	Successful career and Entrepreneurship: An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.



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ATTAINMENT OF PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES

S. No	Experiment	Program Outcomes Attained	Program Specific Outcomes Attained
1.	Basic Arithmetic And Boolean Operations	PO1, PO 12	PSO1, PSO2
2.	Sum Of 'N' Numbers Using 'For' Loop And Factorial Of A Give Number Using For Loop	PO1, PO2, PO 12	PSO1, PSO2
3.	Sum Of 'N' Natural Numbers Using While Loop And Factorial Of A Give Number Using While Loop	PO1, PO2, PO 12	PSO1, PSO2
4.	Convert Degree Centi Grated To Fharan Heat Create A Sub Vi	PO1, PO5, PO 12	PSO1, PSO2
5.	Array Maximum And Minimum And Sorting Even Numbers Using While Loop In An Array	PO1, PO5, PO 12	PSO1, PSO2
6.	Analyzing And Logging Data By Using Wave Form Graphs	PO1, PO5, PO 12	PSO1, PSO2
7.	Bundle And Unbundle Cluster	PO1, PO2, PO11	PSO1, PSO2
8.	Flat And Stacked Sequence	PO1, PO2, PO11	PSO1, PSO2
9.	Application Using Formula Node & Discrete Cosine Transform	PO1, PO5, PO 12	PSO1, PSO2
10.	Median filter	PO1, PO2, PO11	PSO1, PSO2
11.	Convolution Of Two Signals	PO1, PO2, PO11	PSO1, PSO2
12.	Windowing Technique	PO1, PO2, PO11	PSO1, PSO2
13.	Data Acquisition Through Virtual	PO1, PO2, PO11	PSO1, PSO2
14.	Instrumentation of An Amplifier To Acquire An Ecg Signal	PO1, PO2, PO11	PSO1, PSO2



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Certificate

This is to Certify that it is a bonafide record of Practical work done by Sri/Kum. _____ bearing the Roll No. _____ of _____ Class _____ Branch in the _____ laboratory during the Academic year _____ under our supervision.

Head of the Department

Lecture In-Charge

External Examiner

Internal Examiner



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Course Overview:

This course provides the basic knowledge of LABVIEW and application of knowledge to understand real time application USING LABVIEW. To prepare students to perform the analysis, design and implement distribute stand alone application using Lab VIEW.

Course Out Comes:

Upon the completion of Instrumentation laboratory practical course, the student will be able to:

1. Familiar with Virtual Instrumentation.
2. Understand the logical and arithmetic operation using lab view.
3. Understand the concepts Arrays, loops, stack structures bundle functions.
4. Design the automation application like home automation, robotic based applications.
5. Analyze circuit performance with signal source from Lab view



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Electronics & Communication Engineering

INSTRUCTIONS TO THE STUDENTS

1. Students are required to attend all labs.
2. Students should work individually in the hardware and software laboratories.
3. Students have to bring the lab manual cum observation book, record etc. along with them whenever they come for lab work.
4. Should take only the lab manual, calculator (if needed) and a pen or pencil to the work area.
5. Should learn the pre lab questions. Read through the lab experiment to familiarize themselves with the components and assembly sequence.
6. Should utilize 3 hours 'time properly to perform the experiment and to record the readings. Do the calculations, draw the graphs and take signature from the instructor.
7. If the experiment is not completed in the stipulated time, the pending work has to be carried out in the leisure hours or extended hours.
8. Should submit the completed record book according to the deadlines set up by the instructor.
9. For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks and 50 end examination marks.
10. Out of 25 internal marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting an internal laboratory test.



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Electronics & Communication Engineering

INSTRUMENTATION LABORATORY

S. No.	List of Experiments	Page No.
1.	Basic arithmetic and boolean operations	
2.	Sum of 'n' numbers using 'for' loop and factorial of a give number using for loop	
3.	Sum of 'n' natural numbers using while loop and factorial of a give number using while loop	
4.	Convert ⁰ c to ⁰ f,create a sub vi	
5.	Array maximum and minimum and sorting even numbers using while loop in an array	
6.	Analyzing and logging data by using wave form graphs	
7.	Bundle and unbundle cluster	
8.	Flat and stacked sequence	
9.	Application using formula node & discrete cosine transform	
10.	Median filter	
11.	Convolution of two signals	
12.	Windowing technique	
13.	Data acquisition through virtual	
14.	Instrumentation of an amplifier to acquire an ecg signal	

EXPERIMENT NO: 1

BASIC ARITHMETIC AND BOOLEN OPERATIONS

AIM: To perform basic arithmetic and Boolean operations using Lab view.

LEARNING OBJECTIVE:

- To understand the Arithmetic operation using lab view
- To understand the Boolean operation using lab view

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

THEORY:

Basic Arithmetic and logical operation are performed using lab view and the outputs are observed in front panel and block diagram construction also done using lab view.

ALGORITHM:

Step 1: Start the Lab view and select the blank VI.

Step 2: Create front and block diagram panel.

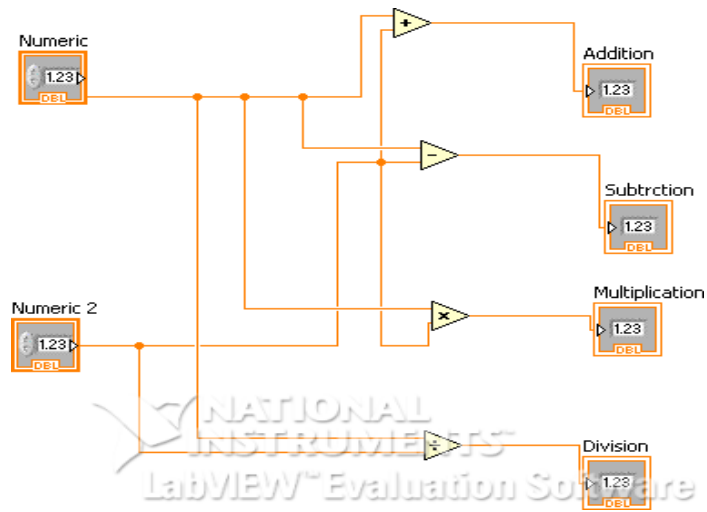
Step 3: Numeric controls are given as inputs and numeric indicators are given as output they are selected by right clicking on the front panel.

Step 4: Different arithmetic operators such as addition, subtraction, multiplication and division are generated in block diagram panel.

Step 5: Using wiring operation inputs and outputs are connected to the respective operators in the block diagram panel.

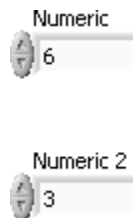
Step 6: Input values are given in the front panel and the program is executed. Hence the output is generated

Block Diagram Panel:

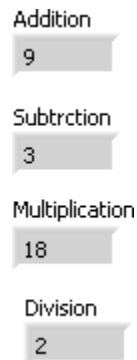


Front Panel:

Input:



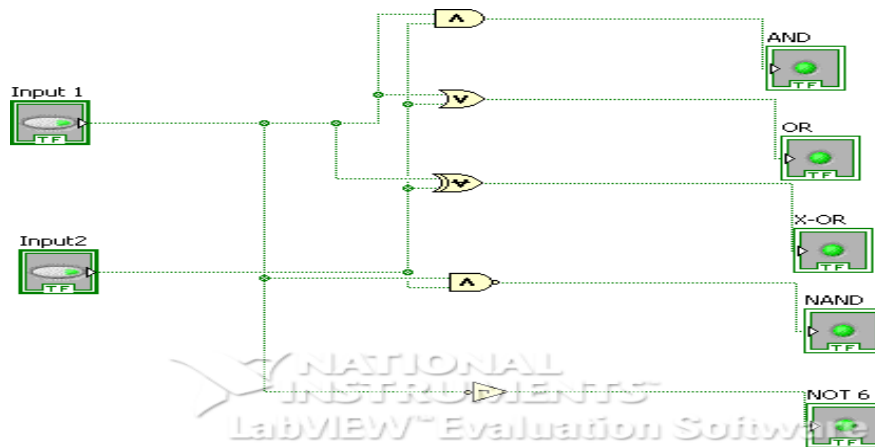
Output:



ALGORITHM FOR BOOLEAN OPERATION

- Step 1: Start the Lab view and select the blank VI.
- Step 2: Create front and block diagram panel.
- Step 3: To perform Boolean operation push buttons are taken as inputs and round LED as output.
- Step 4: Different Boolean operations such as AND, OR, XOR, NOT, NAND are selected from the block diagram panel.
- Step 5: Boolean inputs and outputs are wired in the block diagram panel.
- Step 6: Logic values 0 & 1 are given in the front panel and the program is executed.

Block diagram:



Front Panel:

Input:



Output:



Truth Table:

AND:

X1	X2	Y
0	0	0
0	1	0
1	0	0
1	1	1

OR:

X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	1

XOR:

X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	0

NAND:

X1	X2	Y
0	0	1
0	1	1
1	0	1
1	1	0

NOT:

X	Y
0	1
1	0

RESULT: Thus the arithmetic operations were performed and the result is verified using lab view.

VIVA QUESTIONS:

1. What are arithmetic operations?
2. What are Boolean operations?

EXPERIMENT NO 2

SUM OF 'n' NUMBERS USING 'FOR' LOOP AND FACTORIAL OF A GIVE NUMBER USING FOR LOOP

Aim: To find the sum of 'n' numbers using FOR loop and factorial of a given number using FOR loop

LEARNING OBJECTIVE:

- To understand the for loop and factorial of a given numbers using lab view.

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

THEORY:

Basic for loop function for a given numbers and finding factorial figure (a) shows the basic for loop and figure (b) shows factorial function.

ALGORITHM:

Step 1: Create blank VI.

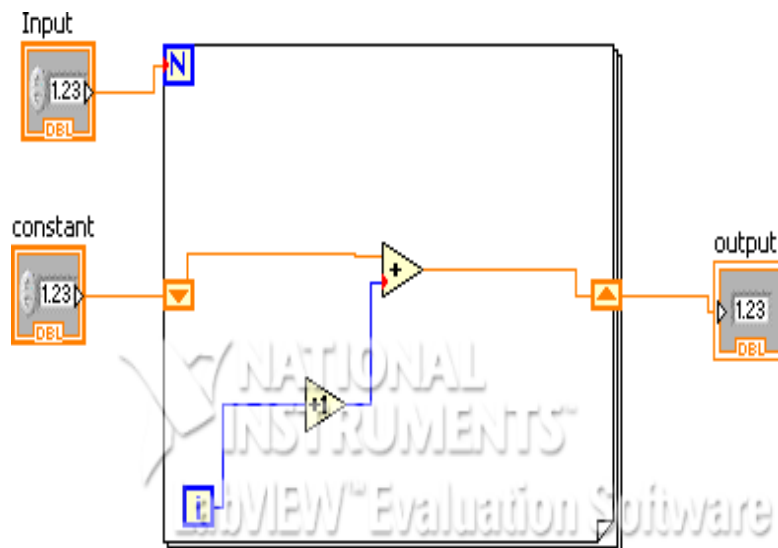
Step 2: Right click on the block diagram panel, select program, go to structures and select a FOR loop.

Step 3: Right click on the border of the FOR loop and select add shift register; borders are converted into shift register.

Step 4: Using wiring operations required connections are given in the block diagram.

Step 5: Inputs are given in the front panel and the program is executed.

BLOCK DIAGRAM:



Front Panel:

Input:

Input
10

constant
0

Output:

output
55

PROCEDURE FOR FACTORIAL OF A GIVE NUMBER USING FOR LOOP

Step 1: Create blank VI.

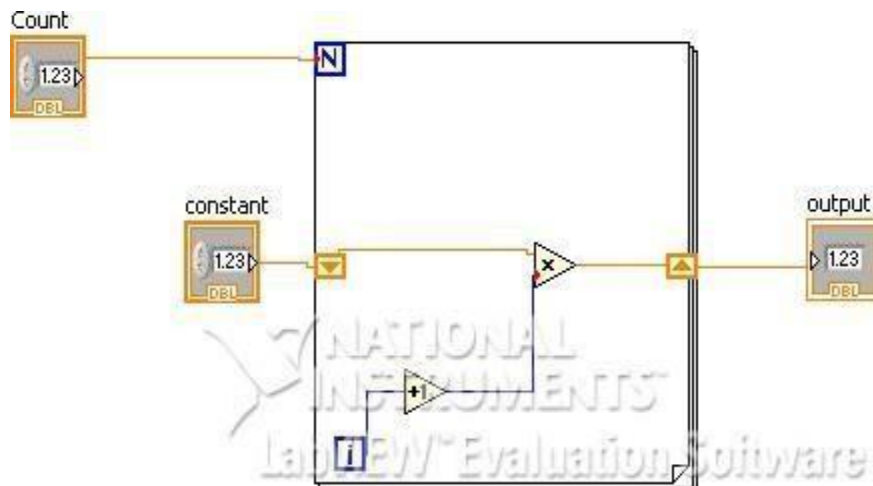
Step 2: Right click on the block diagram panel , select program , go to structures and select a FOR loop.

Step 3: Right click on the border of the FOR loop and select add shift register, borders are converted into shift register.

Step 4: Using wiring operations required connections are given in the block diagram.

Step 5: Inputs are given in the front panel and the program is executed.

BLOCK DIAGRAM PANEL:



Front Panel:

Input:

Count
6

constant
1

Output:

output
720

RESULT: Thus the sum of 'n' natural numbers and factorial of a given number is using FOR loop is performed in LAB view.

VIVA QUESTIONS:

1. What is the factorial formula?
2. What is loop function?

EXPERIMENT NO 3

SUM OF 'n' NATURAL NUMBERS USING WHILE LOOP AND FACTORIAL OF A GIVE NUMBER USING WHILE LOOP

AIM: To find the sum of n natural numbers using while loop.

LEARNING OBJECTIVE:

- To understand the while loop and factorial of a given numbers using lab view.

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

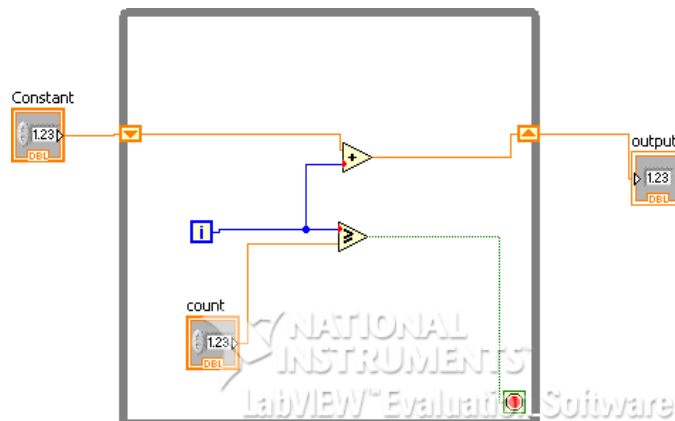
THEORY:

The count terminal specifies the number of times to execute the code inside the For Loop. If you wire 0 or a negative number to the count terminal, the loop does not execute. This terminal is displayed by default. Executes its sub diagram n times, where n is the value wired to the count (N) Terminal. The iteration (i) terminal provides the current loop iteration count, which ranges from 0 to $n-1$.

ALGORITHM:

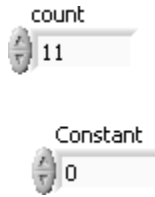
- Step 1: Create blank VI.
- Step 2: Right click on the block diagram panel, select program, go to structures and select a WHILE loop.
- Step 3: The tunnels of the border are converted to shift register.
- Step 4: Generate an adder and greater than equal to inside the WHILE loop.
- Step 5: Using wiring operation required wiring is done in the block diagram panel.
- Step 6: Input values are given in front panel and the output is generated.

BLOCK DIAGRAM PANEL:

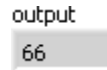


FRONT PANEL:

Input:



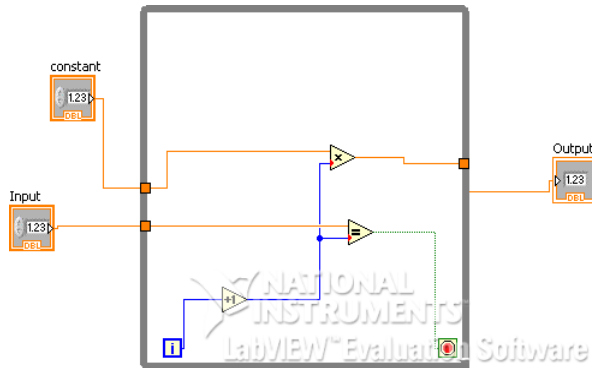
Output:



ALGORITHM FOR FACTORIAL OF A GIVE NUMBER USING WHILE LOOP

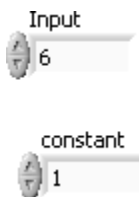
- Step 1: Create blank VI.
- Step 2: Right click on the block diagram panel, select program, go to structures and select a WHILE loop.
- Step 3: Right click on the border of the WHILE loop and select add shift register; borders are converted into shift register.
- Step 4: Using wiring operations required connections are given in the block diagram.
- Step 5: Inputs are given in the front panel and the program is executed.

BLOCK DIAGRAM PANEL:

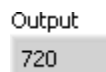


Front Panel:

Input:



Output:



RESULT: Thus the sum of n natural numbers and factorial of a given number using WHILE loop is performed.

VIVA QUESTIONS:

1. What is while loop?
2. What is the difference between while and for loop?

EXPERIMENT NO 4

CONVERT °C TO °F, CREATE A SUB VI

AIM: To convert the centigrade to foreign heat using a sub VI

LEARNING OBJECTIVE:

- To understand the conversion of °C to °F using lab view

THEORY:

Complete the following steps to create a VI that takes a number representing degrees Celsius and converts it to a number representing degrees Fahrenheit.

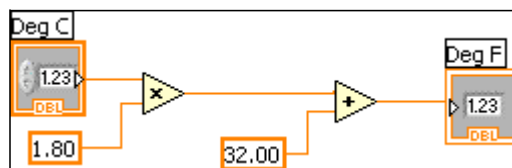
COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

ALGORITHM:

- . Step 1: Create blank VI.
- Step 2: Right click on the block diagram panel, select program, go to numeric's and select a numeric function.
- Step 3: place all the numeric's which required for the program .
- Step 5: Inputs are given in the front panel and the program is executed.

CIRCUIT DIAGRAM:



Create a SubVI

Front Panel:

The following front panel appears.



1. Right-click the icon in the upper right corner of the front panel and select **Edit Icon** from the shortcut menu. The **Icon Editor** Dialog box appears.

2. Double-click the Select tool on the left side of the **Icon Editor** Dialog box to select the default icon.
3. Press the <Delete> key to remove the default icon.
4. Double-click the Rectangle tool to redraw the border.
5. Create the following icon.
 - a. Use the Select tool and the arrow keys to move the text and arrow you created.
 - b. Select the **B&W** icon and select **256 Colors** in the **Copy from** field to create a black and white icon, which Lab VIEW uses for printing unless you have a color printer.
 - c. When the icon is complete, click the **OK** button to close the **Icon Editor** Dialog box. The icon appears in the upper right corner of the front panel and block diagram.
6. Right-click the icon on the front panel and select **Show Connector** from the shortcut menu to define the connector pane terminal pattern.
 Lab VIEW selects a connector pane pattern based on the number of controls and indicators on the front panel. For example, this front panel has two terminals, **deg C** and **deg F**, so Lab VIEW selects a connector pane pattern with two terminals.
7. Assign the terminals to the digital control and digital indicator.
 - a. Select **Help» Show Context Help** to display the **Context Help** window. View each connection in the **Context Help** window as you make it.
 - b. Click the left terminal in the connector pane. The tool automatically changes to the Wiring tool, and the terminal turns black.
 - c. Click the **deg C** control. The left terminal turns orange, and a marquee highlights the control.
 - d. Click an open area of the front panel. The marquee disappears, and the terminal changes to the data type color of the control to indicate that you connected the terminal.
 - e. Click the right terminal in the connector pane and click the **deg F** indicator. The right terminal turns orange.
 - f. Click an open area on the front panel. Both terminals are orange.
 - g. Move the cursor over the connector pane. The **Context Help** window shows that both terminals are connected to floating-point values.
8. Select **File» Save** to save the VI because you will use this VI later in the course.
9. Select **File» Close** to close the Convert C to F VI.

RESULT: conversion of the centigrade to foreign heat using a sub VI is performed

VIVA QUESTIONS:

1. What is sub vi?
2. What is the use of sub vi?

EXPERIMENT NO 5

ARRAY MAXIMUM AND MINIMUM AND SORTING EVEN NUMBERS USING WHILE LOOP IN AN ARRAY

AIM: To find the maximum and minimum variable from an array.

LEARNING OBJECTIVE:

- To understand the maximum and minimum in array using lab view
- To understand the sorting even number in array using lab view

THEORY:

Complete the following steps to find minimum and maximum and sorting the even numbers in an array

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

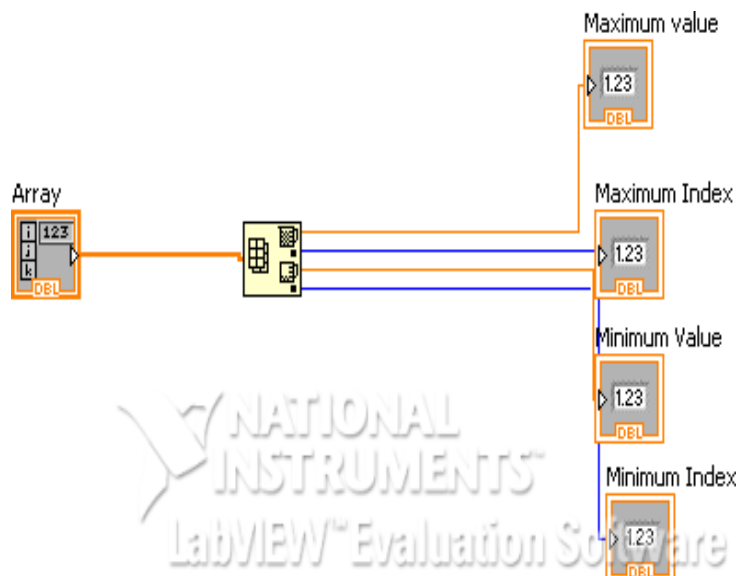
ALGORITHM:

Step 1: Create blank VI.

Step 2: Right click on the front panel →modern →array→ array matrix→ numeric control. Step 3: Create four numeric indicators in the front panel for maximum variable, index, minimum variable and index.

Step 4: Using wiring operations required connections are given in the block diagram. Step 5: Inputs are given in the front panel and the program is executed.

BLOCK DIAGRAM PANEL:



Front Panel:

Input:



Output:

Maximum value

6

Maximum Index

1

Minimum Value

1

Minimum Index

4

ALGORITHM FOR SORTING OF NUMBERS USING WHILE LOOP

Step 1: Create blank VI.

Step 2: Right click on the block diagram panel, select program, go to structures and select a WHILE loop.

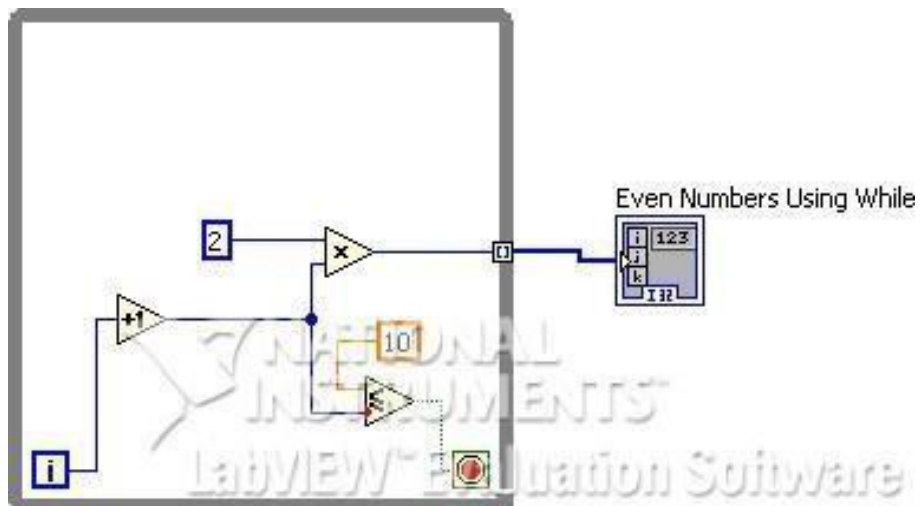
Step 3: Create an array in the front panel and add numeric indicator to it.

Step 4: Add the numeric control in the front panel.

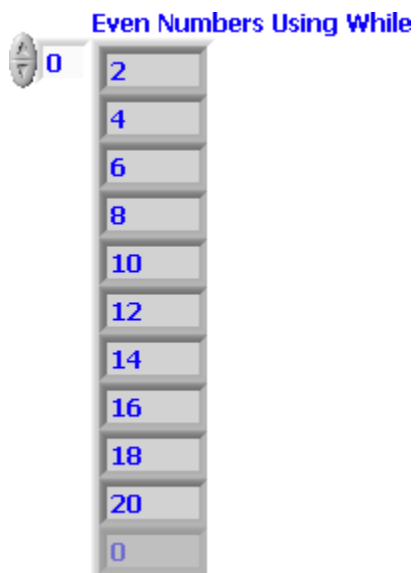
Step 5: Using wiring operations required connections are given in the block diagram.

Step 6: Inputs are given in the front panel and the program is executed

BLOCK DIAGRAM PANEL:



FRONT PANEL:



RESULT: Thus the maximum and minimum and sorting the even numbers from the given set of numbers using WHILE loop in an array is displayed.

VIVA QUESTIONS:

1. What is an array?
2. What is maximum and minimum array?

EXPERIMENT NO 6

ANALYZING AND LOGGING DATA BY USING WAVE FORM GRAPHS

AIM: To Analysing and logging data by using lab view.

LEARNING OBJECTIVE:

- To understand the data analyzing using lab view
- To understand the usage of wave form graphs using lab view

COMPONENTS REQUIRED:

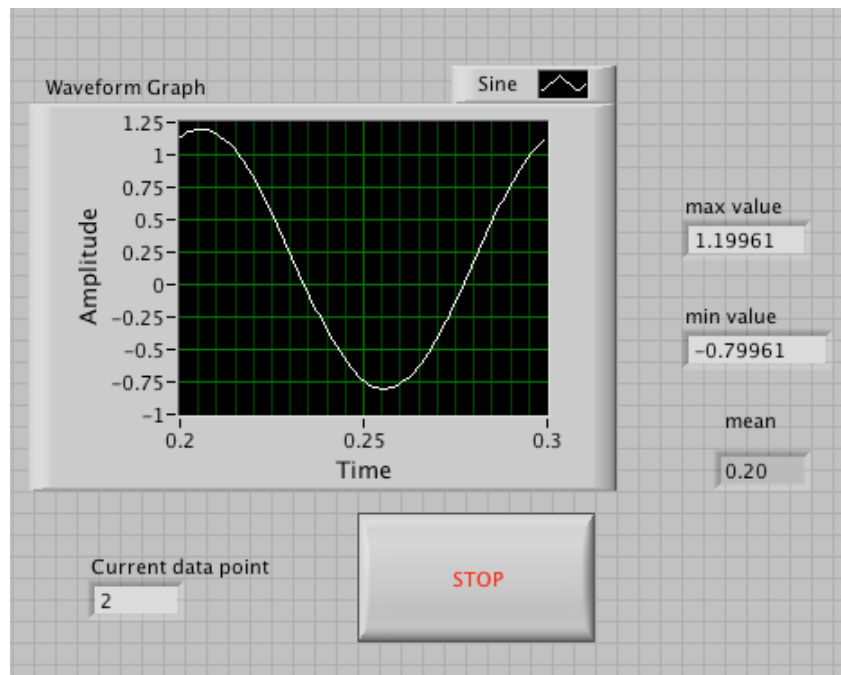
1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

THEORY:

Complete the following steps to build a VI that measures temperature every 0.25 s for 10s. During the acquisition, the VI displays the measurements in real time on a waveform chart. After the acquisition is complete, the VI plots the data on a graph and calculates the minimum, maximum, and average temperatures. The VI displays the best fit of the temperature graph.

ALGORITHM:

1. Open a new VI and build the following front panel using the following tips.



- Do not create the **Mean**, **Max**, and **Min** indicators yet. Create them on the Block Diagram by right clicking on the functions and choosing Create Indicator. Then position them on the Front Panel.

BLOCK DIAGRAM

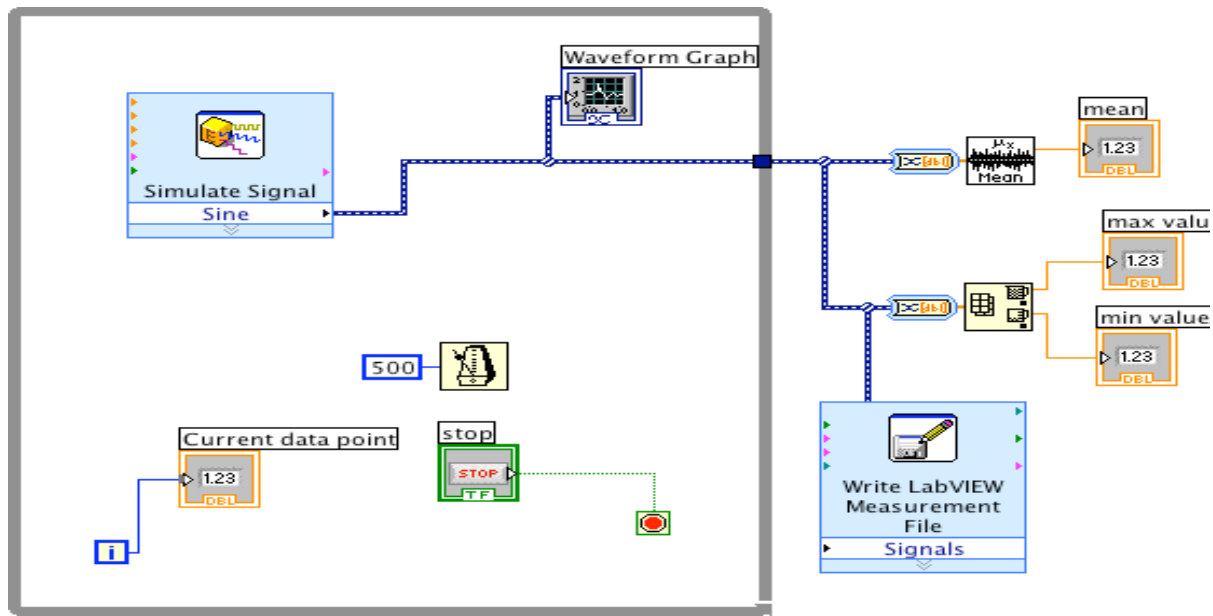
2. Build the following block diagram.
 - a. Select the **Functions» Input» Simulate Signal**.
 - b. Choose a frequency, Amplitude, and an offset
 - c. Place the Wait Until Next ms Multiple function located on the **Functions» All Functions »Time & Dialog** palette and create a constant of 250. Much like the Time Delay Express VI, this function causes the For Loop to execute every 0.25 s (250 ms).
 - d. Place the Array Max & Min function located on the **Functions» All Functions »Array** palette. This function returns the maximum and minimum amplitude of the wave.
 - e. Place the Mean VI located on the **Functions» All Functions» Analyze» Mathematics» Probability and Statistics** palette. This VI returns the average of the amplitude of the wave.
 - f. Right-click the output terminals of the Array Max & Min function and Mean VI and select **Create» Indicator** from the shortcut menu to create the **Max**, **Min**, and **Mean** indicators.
 - g. Place the Write Lab VIEW Measurements File Express VI located on the **Functions» Output** palette. Configure the VI to ask the user to choose the file to write and change the delimiter to Tab
3. Save the VI as Temperature Logger.vi.
4. Display the front panel and run the VI.
5. After pressing STOP a dialog box will appear. Enter the name of the file to save the spreadsheet.
6. Open the spreadsheet file to make sure the file was properly created by using Notepad or Excel, or by creating a VI to read the file as follows.
 - Create the following block diagram



- Place the Read Lab VIEW Measurement File Express VI located on the **Functions » Input** palette.
- Configure the VI to ask the user to choose the file to read and change the delimiter to Tab
- Right click on the Signals Output and choose create graph indicator

7. Run the VI
8. Save and close both of the VI s.

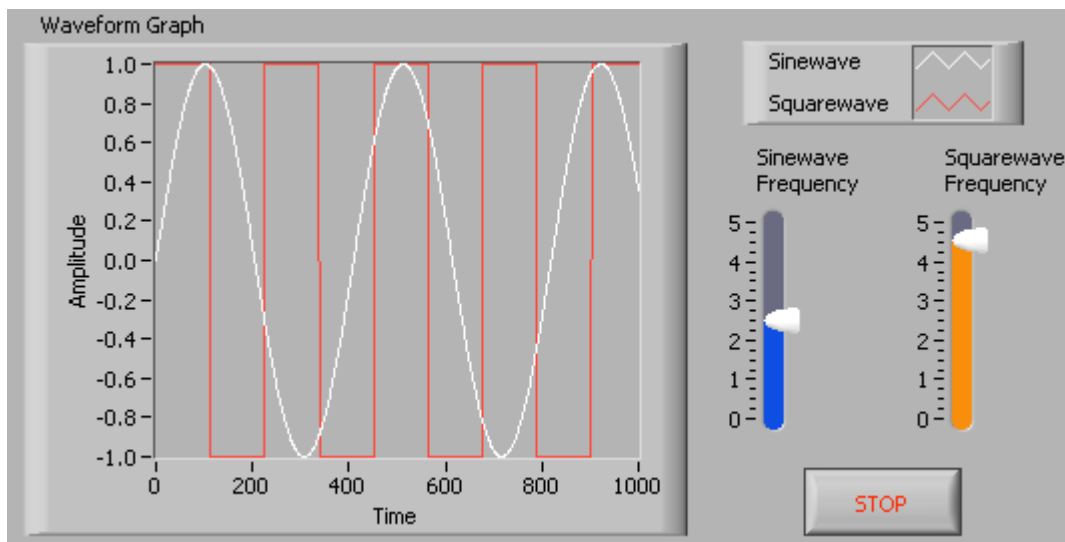
BLOCK DIAGRAM:



ALGORITHM USING WAVEFORM GRAPHS

Front Panel

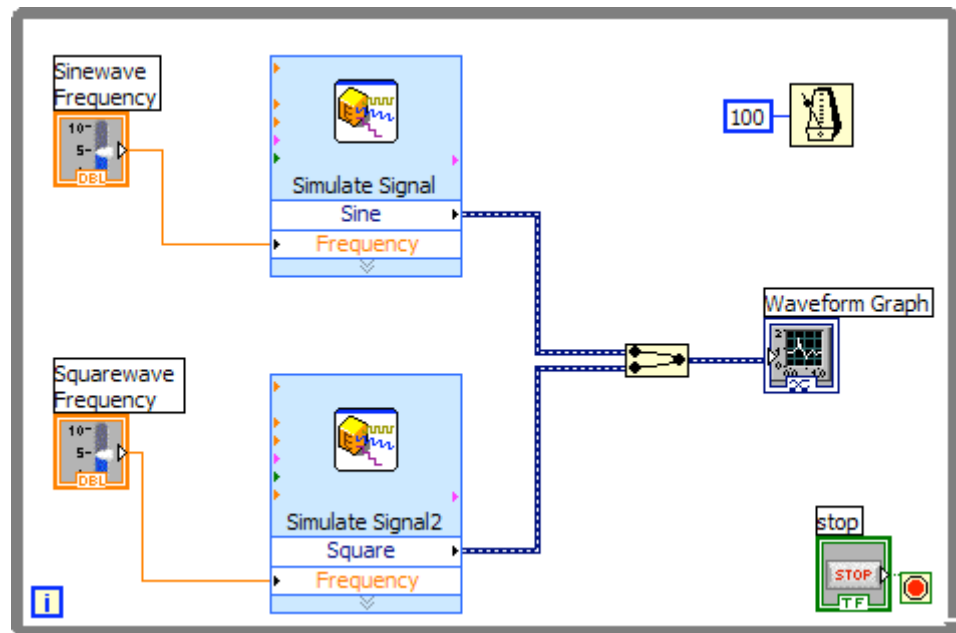
1. Open a new VI and build the following front panel using the following tips.



- a. Create a waveform graph indicator from the **Controls» Graph Indicators** palette. Use the position/size/select tool to move the plot legend to the side, and expand it to display two plots. Use the labeling tool to change the plot names and the properties page to choose different colors for your plots.
- b. Place a Stop button on the front panel.
- c. Place two vertical pointer slides from the **Controls» Numeric Controls** palette. Use the properties page again to change the slide fill color.

BLOCK DIAGRAM

1. Build the following block diagram.



- a. Place a While Loop from **Functions» Execution Control** palette.
 - b. Place a **Wait Until Next ms Multiple** from **Functions» All Functions »Time & Dialog** and create a constant with a value of 100.
 - c. Place two Simulate Signal Express VIs from the **Functions» Input** and leave the Signal type as Sine for the first Simulate Signal VI and change the Signal Type to Square for the second VI. Wire both of the outputs into the waveform graph. A Merge Signals function will automatically be inserted.
 - d. Expand the Simulate Signal Express VIs to show another Input / Output. By default, error out should appear. Change this to Frequency by clicking on error out and choosing **Frequency**.
2. Save the VI as Multi plot Graph.vi.
 3. Display the front panel and run the VI.
 4. Save and close the VI.

RESULT: Hence analyzing the data by using wave forms is performed.

VIVA QUESTIONS:

1. How can we acquire the wave forms in lab wave?
2. what is logging a data?

EXPERIMENT NO 7

BUNDLE AND UNBUNDLE CLUSTER

AIM: To bundle and unbundle a cluster.

LEARNING OBJECTIVE:

- To understand the arithmetic operation using lab view
- To understand the Boolean operation using lab view

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

THEORY:

Use this border node to perform operations on one or more cluster elements and replace the elements in the same location in the cluster. Each cluster element you unbundle with the border node on the left side of the structure must be bundled back into the cluster with the border node on the right side of the structure. This node allows the Lab VIEW compiler to avoid storing a complete value copy of the cluster and cluster elements in memory.

The border node on the left side of the structure is similar to the Unbundle by Name function. The border node on the right side of the structure is similar to the Bundle by Name function.

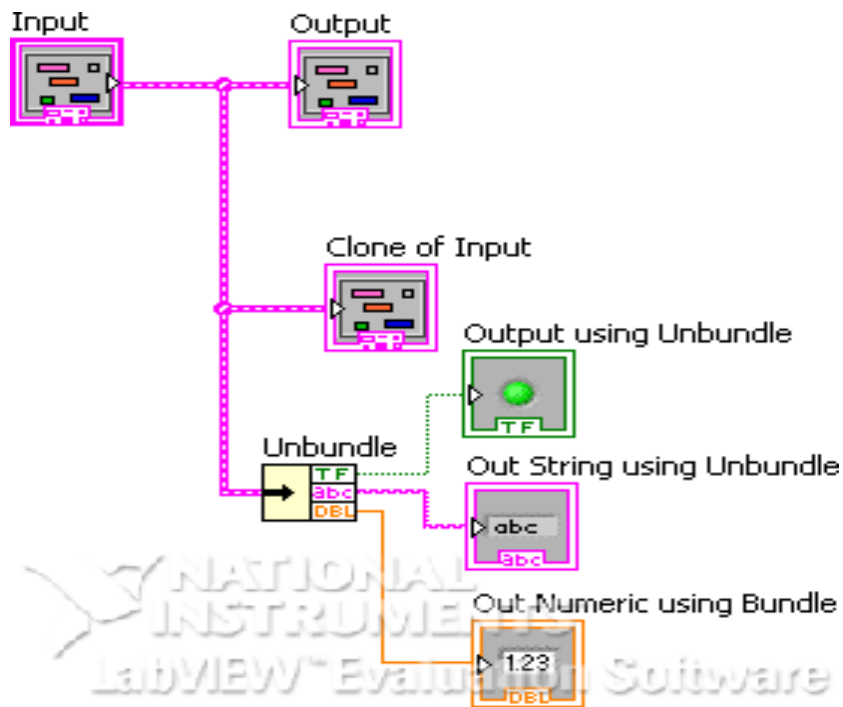
ALGORITHM:

- Step 1: Create blank VI.
- Step 2: Select numeric control, string control for inputs.
- Step 3: Select bundle operation from a cluster.
- Step 4: Create a new cluster add numeric indicator, string indicator and round LED.
- Step 5: Using wiring operations required connections are given in the block diagram.
- Step 6: Inputs are given in the front panel and the program is executed.

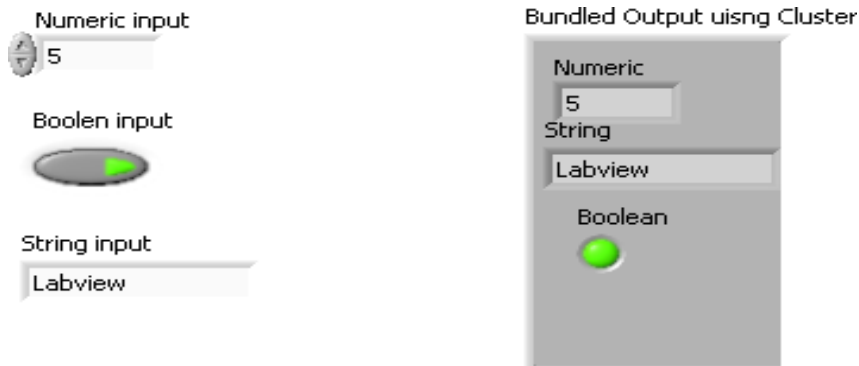
For unbundling cluster:

- Step 1: Create a new VI.
- Step 2: Create a cluster with numeric control, string and round LED. Step 3: Create numeric indicator, Boolean indicator and string indicator.
- Step 4: Using wiring operations required connections are given in the block diagram.
- Step 5: Inputs are given in the front panel and the program is executed.

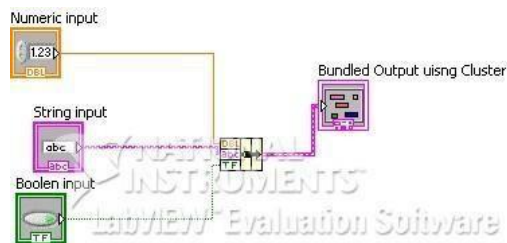
CIRCUIT DIAGRAM:



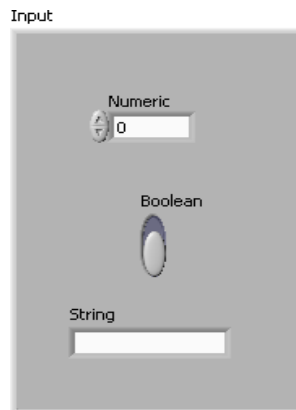
Front Panel: Bundle cluster :



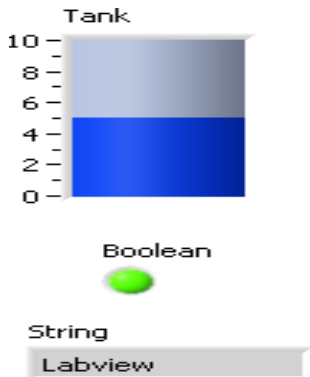
Input:



Unbundle cluster: Input:



Output:



Result: Hence a cluster is bundled and unbundled using Lab VIEW.

VIVA QUESTIONS:

1. What is bundled function?
2. what is unbundled function what is the difference between two?

EXPERIMENT NO 8

FLAT AND STACKED SEQUENCE

AIM: To perform functions using flat and stacked sequence.

LEARNING OBJECTIVE:

- To understand the flat and stacked sequence operation using lab view

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

THEORY:

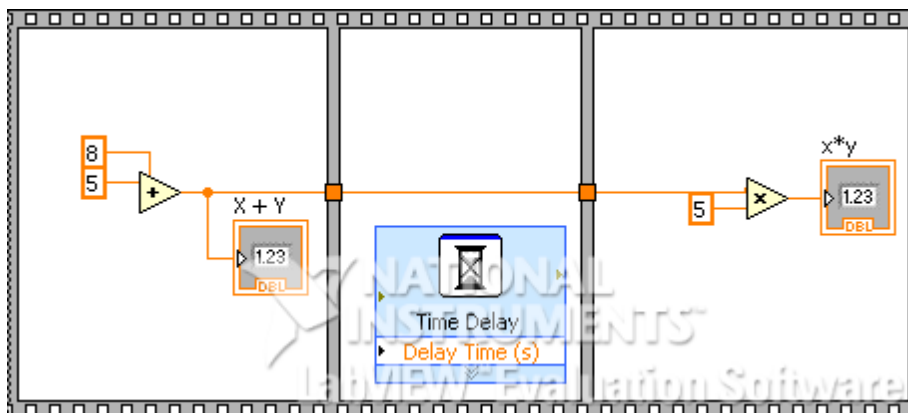
Consists of one or more sub diagrams, or frames, that execute sequentially. Use the Flat Sequence structure to ensure that a sub diagram executes before or after another sub diagram .Data flow for the Flat Sequence structure differs from data flow for other structures. Frames in a Flat Sequence structure execute from left to right and when all data values wired to a frame are available. The data leaves each frame as the frame finishes executing. This means the input of one frame can depend on the output of another frame.

ALGORITHM:

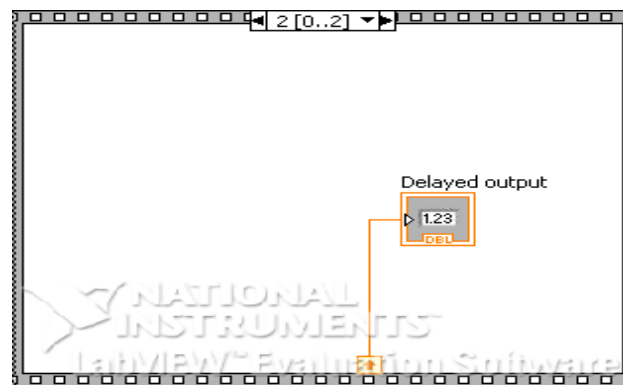
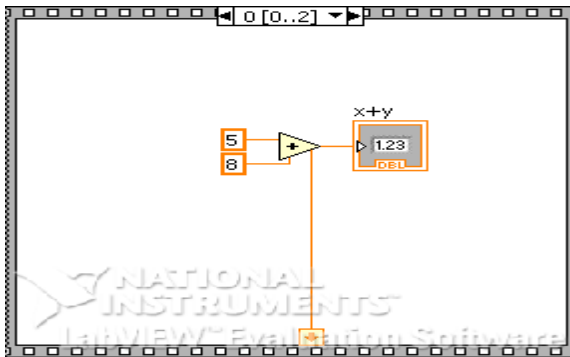
- Step 1: Create blank VI.
- Step 2: Create flat and stacked sequence.
- Step 3: Right click on the boundary and add sequence local connect adder with the boundary.
- Step 4: Using wiring operations required connections are given in the block diagram.
- Step 5: Inputs are given in the front panel and the program is executed.

CIRCUIT DIAGRAM:

Flat sequence:



Stacked sequence:



Front Panel:

Flat sequence:

X + Y
13

x*y
65

RESULT: Thus various functions using flat and stacked sequence using Lab VIEW was performed.

VIVA QUESTIONS:

1. What is a flat sequence?
2. What is the difference between flat sequence and loop functions?

EXPERIMENT NO 9

APPLICATION USING FORMULA NODE & DISCRETE COSINE TRANSFORM

AIM: To perform formula node and discrete cosine transform

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

LEARNING OBJECTIVE:

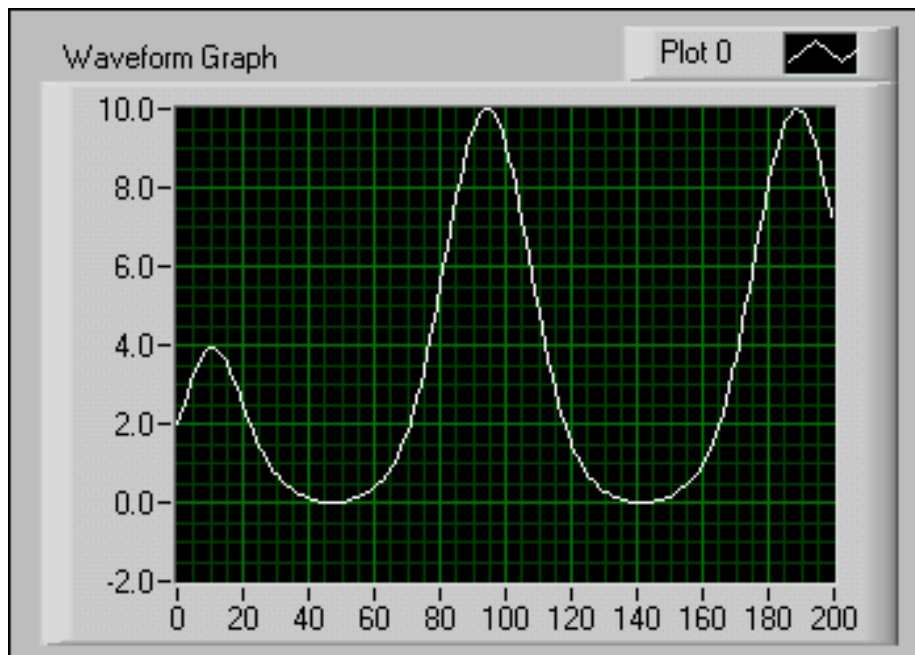
- To understand the formula node and discrete cosine transform operation using lab view

: THEORY:

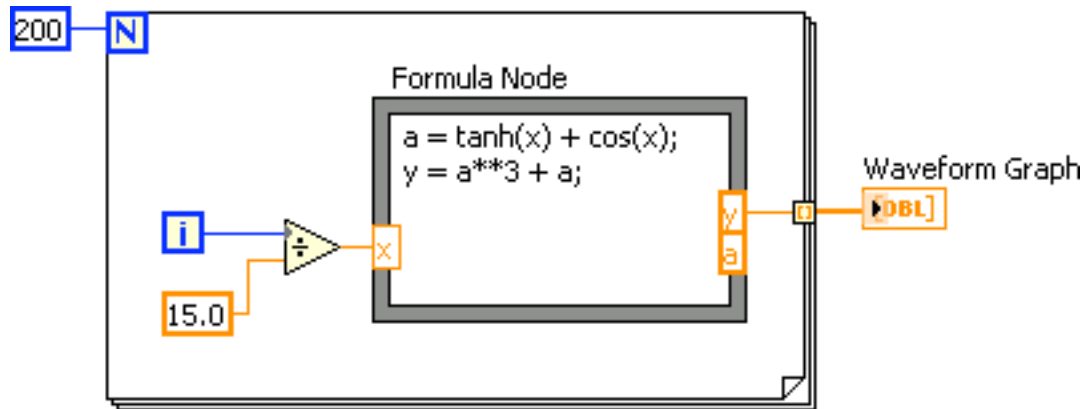
In this exercise, the objective is to use the Formula Node in a VI. Complete the following steps to build a VI that uses the Formula Node to perform a complex mathematical operation and graphs the results.

Front Panel

1. Open a blank VI and build the front panel shown in figure 1. Figure 1



Block Diagram



ALGORITHM:

Place the **Formula Node**, located on the **Functions>>All Functions>>Structures**

Palette , on the block diagram.

1. Create the x input terminal by right-clicking the left border and selecting Add Input from the shortcut menu. Type x in the box that appears.
2. Create the y and a output terminals by right-clicking the right border and selecting Add Output from the shortcut menu. Enter y and a, respectively, in the boxes that appear. You must create output terminals for temporary variables like a.

Note: When you create an input or output terminal, you must use a variable name that exactly matches the one in the equation. Variable names are case sensitive.

3. Type the following equations in the Formula Node, where ** is the exponentiation operator. Refer to the Lab VIEW Help for more information about syntax for the Formula Node.

$$a = \text{Tan h}(x) + \text{Cos}(x) \quad y = a^3 + a$$

4. Complete the block diagram as shown in figure2.
Save the VI as Formula Node Exercise.vi.

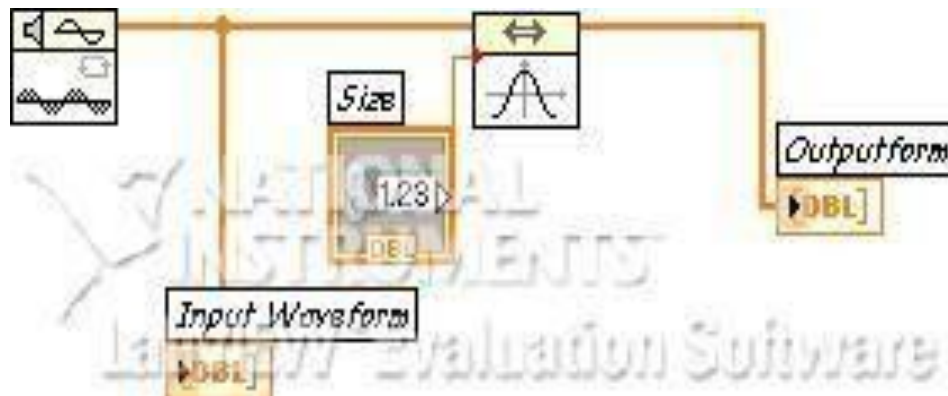
Run the VI

Display the front panel and run the VI. The graph displays the plot of the equation $y = f(x)^3 + f(x)$ where $f(x) = \text{Tan h}(x) + \text{Cos}(x)$. During each iteration, the VI divides the iteration terminal value by 15.0. The quotient is wired to the Formula Node, which calculates the function value. The VI plots the array as a graph.

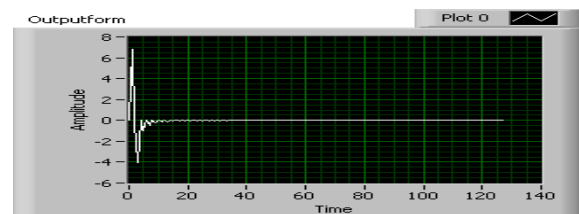
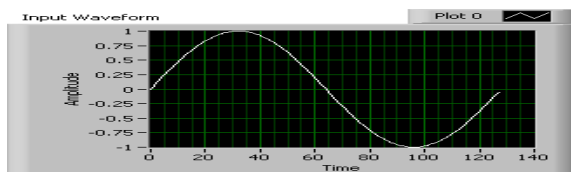
Algorithm:

1. Close the VI.
2. Step 1: Create a blank VI
3. Step 2: Generate a waveform from the signal processing block.
4. Step 3: Create a discrete cosine transform and waveform graph in the front panel.
5. Step 4: Using wiring operations required connections are given in the block diagram.

Block diagram panel:



Front panel:



RESULT: Hence formula node and discrete cosine transform was performed on the given input signal.

VIVA QUESTIONS:

1. What is a formula node?
2. How discrete functions are performed?

EXPERIMENT NO 10

MEDIAN FILTER

AIM: To apply filtering technique for a given input signal.

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

LEARNING OBJECTIVE:

- To understand the median filter using lab view

: THEORY:

In this exercise, the objective is to use the signal processing and creating noise signal and eliminate the noise using median filter.

ALGORITHM:

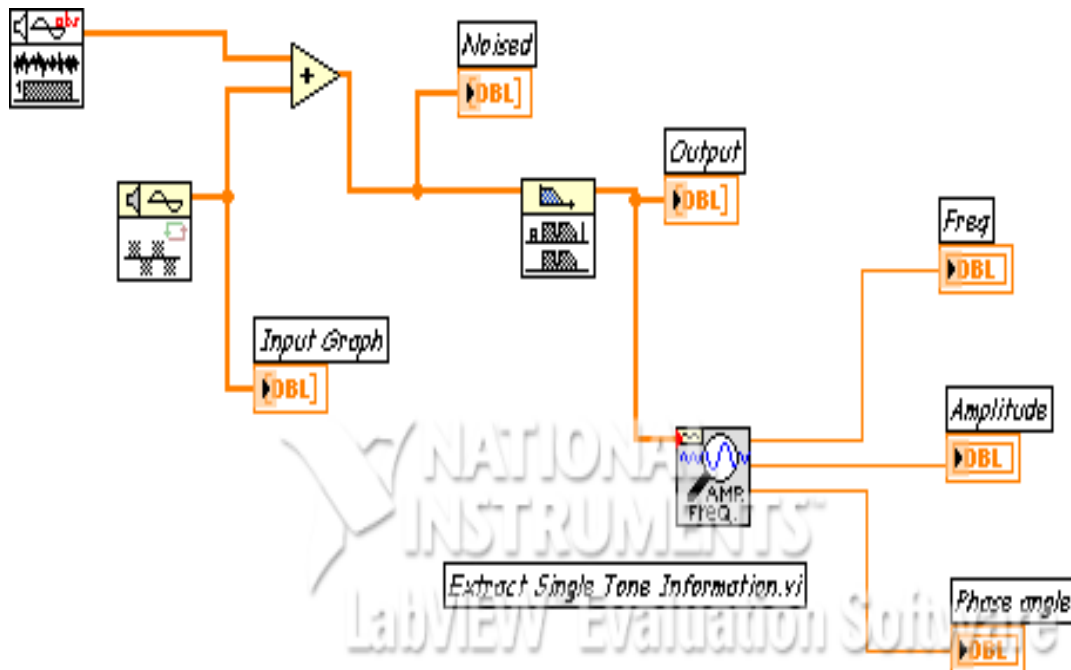
Step 1: Create a blank VI.

Step 2: In the block diagram panel go to signal processing and create a noise signal. Step 3: Select any one input signal.

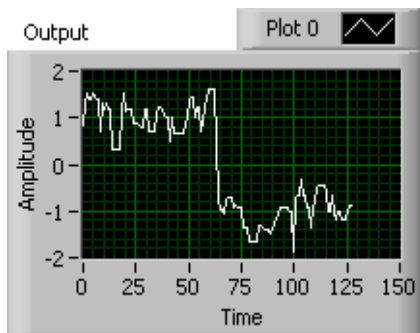
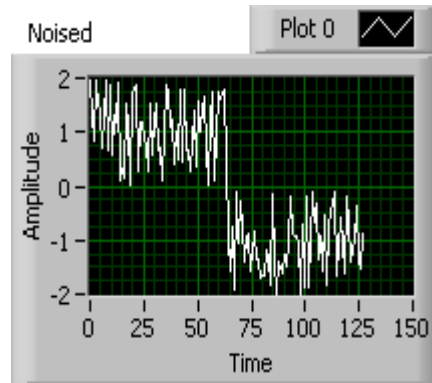
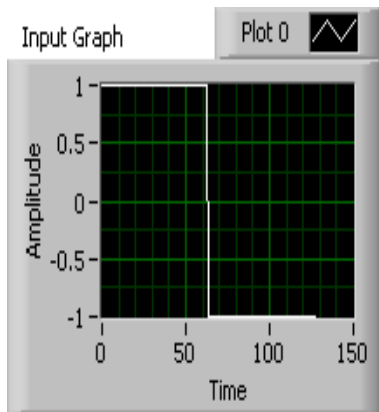
Step 4: Create median filter from signal processing block.

Step 5: Using wiring operations required connections are given in the block diagram. Step 6: Inputs are given in the front panel and the program is executed.

Block diagram panel:



Front panel:



Result: Hence filtering technique is applied on the input signal.

VIVA QUESTIONS:

1. What is noise signal?
2. What is median filter?

EXPERIMENT NO 11

CONVOLUTION OF TWO SIGNALS

AIM: To perform convolution of two signals.

COMPONENTS REQUIRED:

NI Lab VIEW (2015 LV- 64bitWin Eng)
Personal computer

LEARNING OBJECTIVE:

- To understand the convolution of two signals using lab view

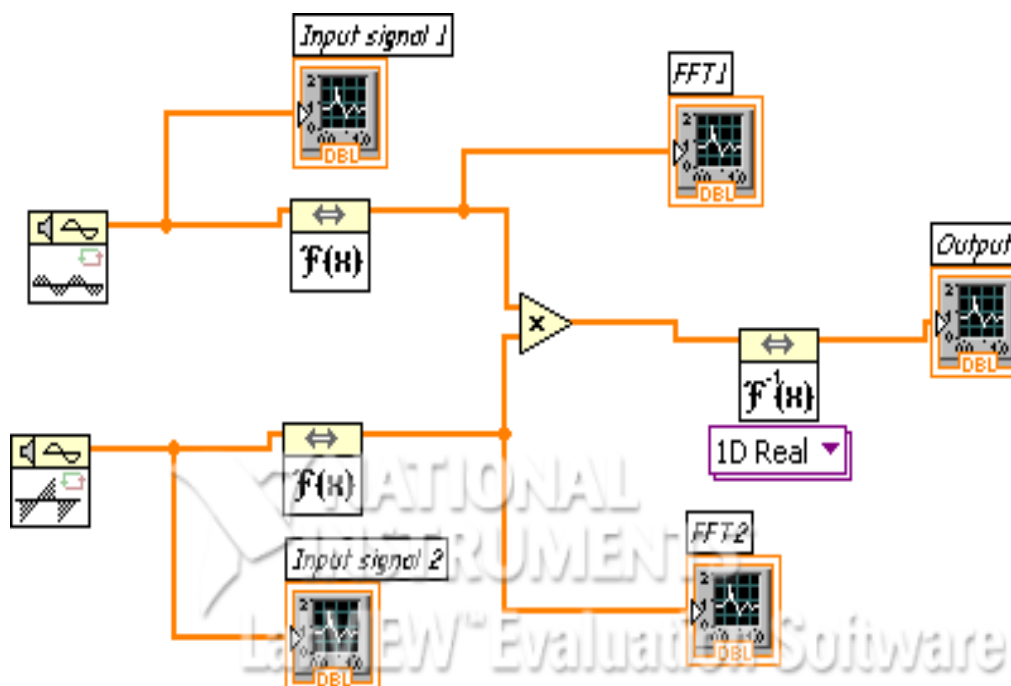
THEORY:

In this exercise, the objective is to use the signal processing and convolution of two signals.

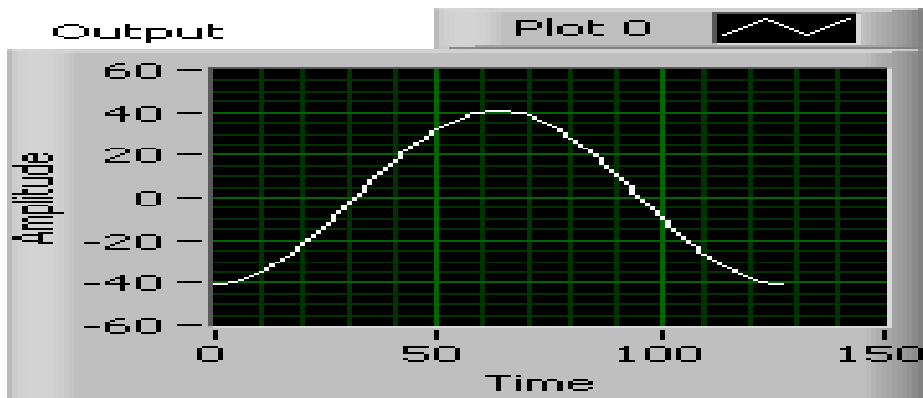
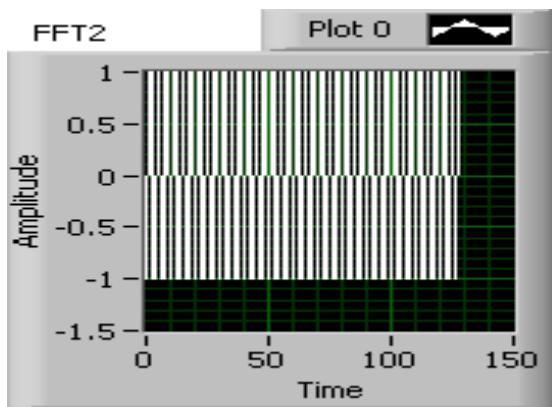
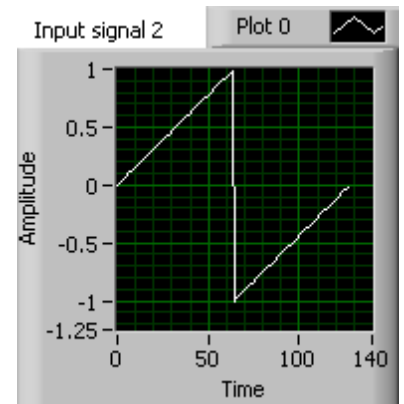
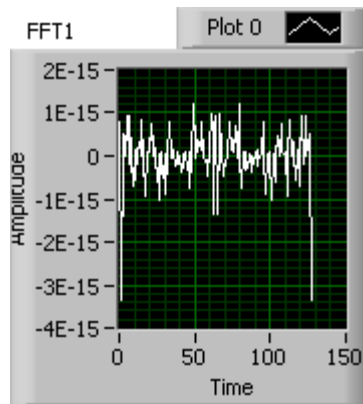
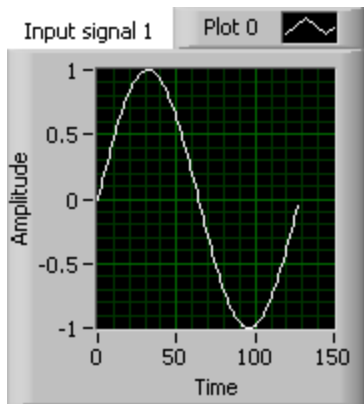
Algoitm:

- Step 1: Create a blank VI.
- Step 2: Create two inputs and waveform graph.
- Step 3: Apply FFT for the two inputs and give it to multiplier.
- Step 4: In the receiver end IFFT is performed and the convolved output is displayed in the waveform graph.

Block Diagram panel:



Front panel:



Result: Hence two signals were convolved and the result is verified during Lab VIEW.

VIVA QUESTIONS:

1. What is a convolution?
2. What is correlation?

EXPERIMENT NO 12

WINDOWING TECHNIQUE

AIM: To apply different windowing technique on the give input signal

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

LEARNING OBJECTIVE:

- To understand the windowing techniques of signals using lab view

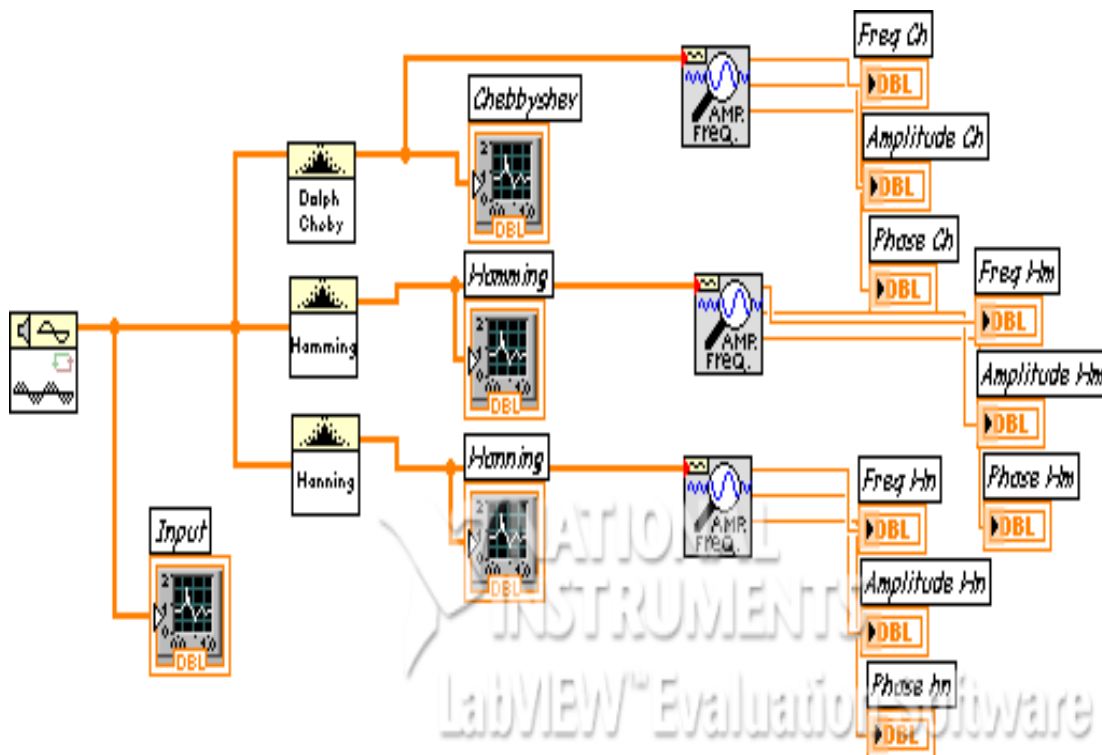
THEORY

In this exercise, the objective is to use the signal processing and windowing technique of a given signals.

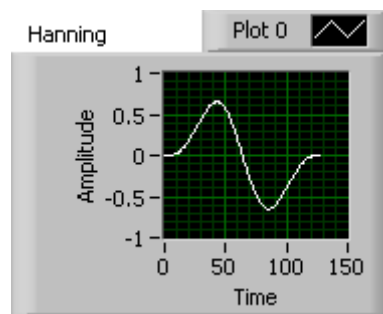
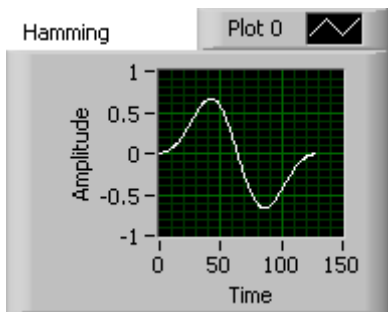
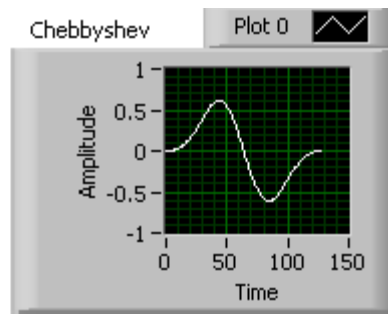
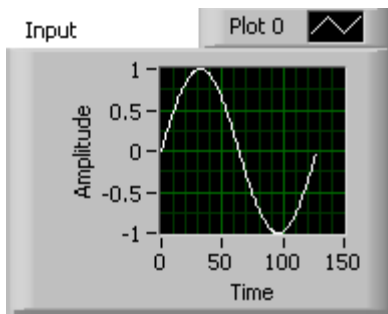
Algorithm:

- Step 1: Create a blank VI.
- Step 2: Create handing, hamming, Blackman, chewy shave window on the block diagram panel.
- Step 3: Generate a input waveform and create extract single tone for all the windows.
- Step 4: Using wiring operations required connections are given in the block diagram.
- Step 5: Inputs are given in the front panel and the program is executed.

Block diagram panel:



Front panel:



Result: Hence the characteristics of various windows are performed using Lab VIEW.

VIVA QUESTIONS:

1. What is an windowing technique?
2. What are various characteristics of windows?

EXPERIMENT NO 13

DATA ACQUISITION THROUGH VIRTUAL INSTRUMENTATION

AIM: To perform the Data acquisition through virtual instrumentation.

LEARNING OBJECTIVE:

- To understand the Data acquisition using lab view

COMPONENTS REQUIRED:

1. NI Lab VIEW (2015 LV- 64bitWin Eng)
2. Personal computer

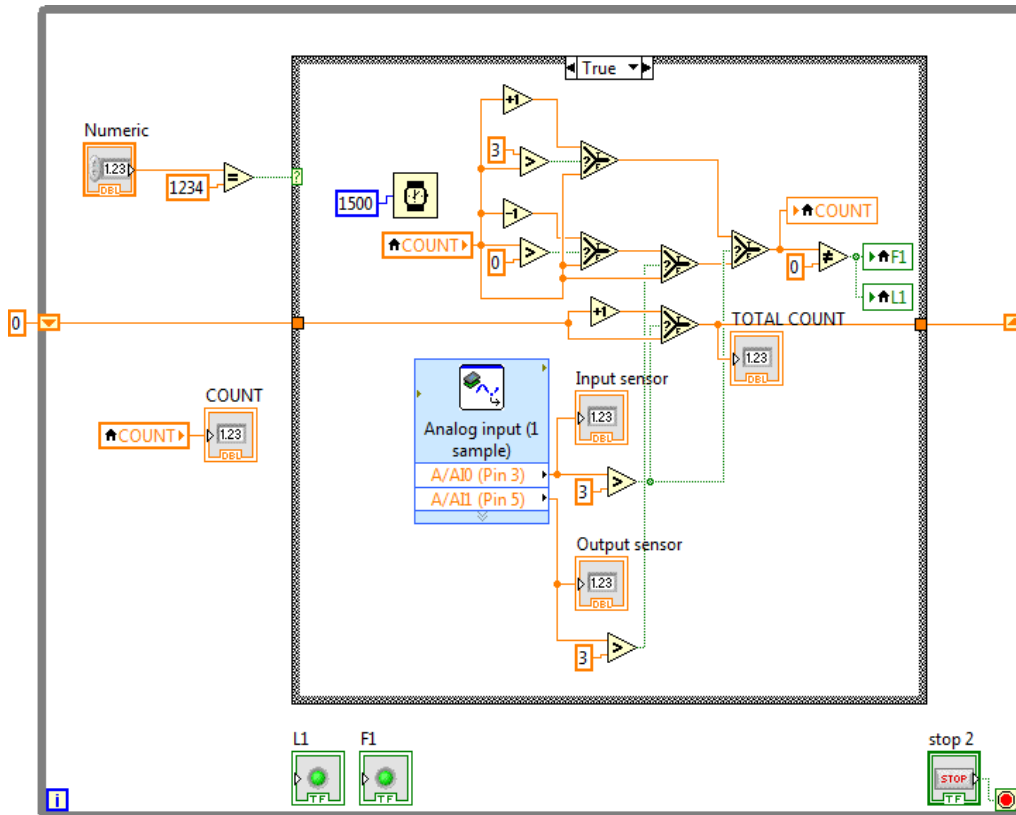
: THEORY:

In this exercise, the objective is to use the DAQ assistant and perform the signal processing.

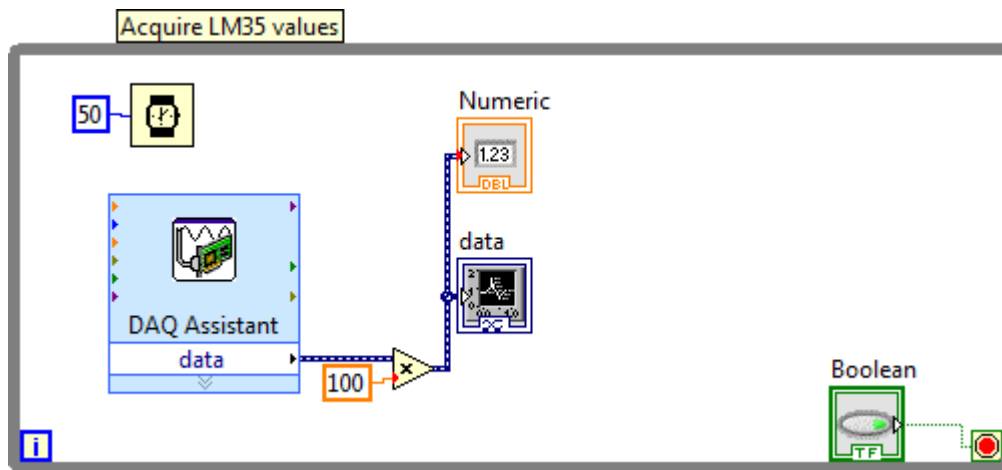
ALGORITHM:

- Step 1: Create blank VI.
- Step 2: Create a for loop .
- Step 3: Using wiring operations required connections are given in the block diagram.
- Step 5: Inputs are given in the front panel and the program is executed.

CIRCUIT DIAGRAM: Front panel



Block Diagram:



RESULT: Data acquisition through virtual instrumentation is performed.

VIVA QUESTIONS:

- 1 What is acquisition?
- 2 How signals are acquire?

EXPERIMENT NO 14

INSTRUMENTATION OF AN AMPLIFIER ACQUIRE AN ECG SIGNAL

Aim: To acquire and analyze an ECG signal using NI ELVIS Lab VIEW.

LEARNING OBJECTIVE:

- To understand the Data acquisition using lab view

COMPONENTS REQUIRED:

- NI Lab VIEW (2015 LV- 64bitWin Eng)
- Personal computer

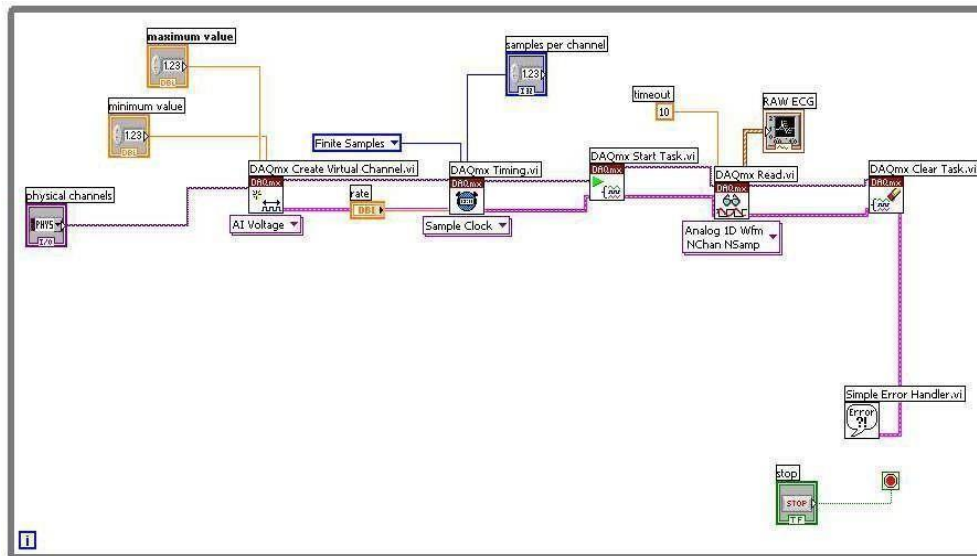
: THEORY:

In this exercise, the objective is to use the DAQ assistant and perform the ECG signal.

Algorithm:

Procedure without Express:

- Construct the basic block diagram for acquiring a signal without using express.

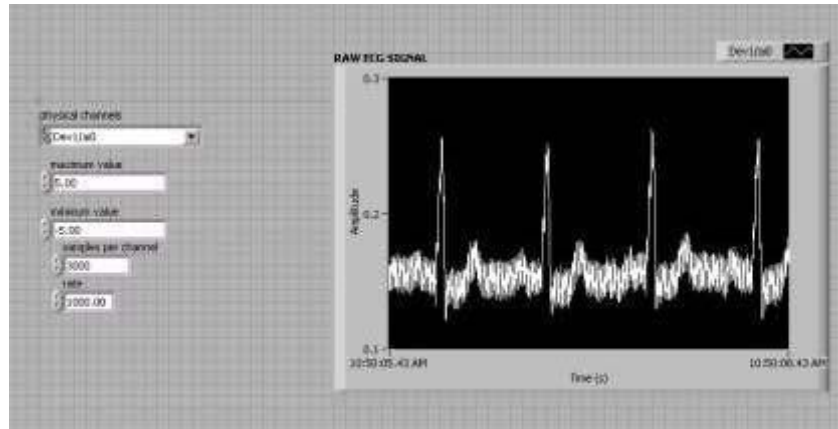


- For acquiring ECG Signal:

* From the front panel, set the number of samples to read as 3000 and the sampling rate as 1000. From the physical channel drop down menu select device and the channel no. (DEVICE 1 / AI0 CHANNEL).

- * Set the Voltage Maximum and Minimum to -5/5 V
- * Save the program (CTRL + S). From the Front panel toolbar menu select
- * Operate → Run (or press CTRL + R) to execute the program.

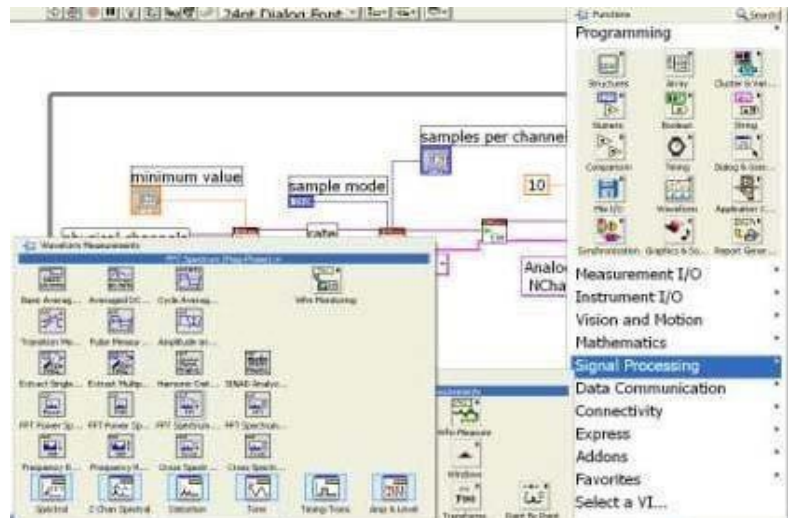
Raw ECG Signal Output:



3. Taking FFT for raw ECG:

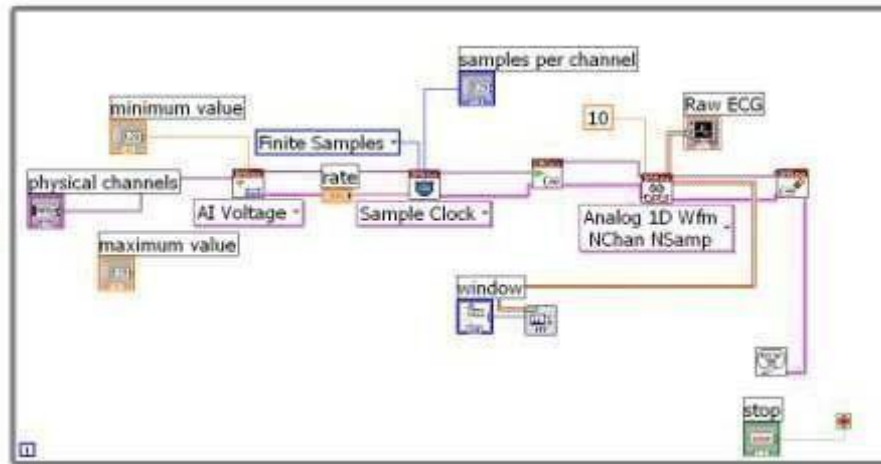
Right click on the block diagram. From the menu appearing select Signal ProcessingWfm Measure FFT Spectrum magnitude and phase. Place the FFT block in the block diagram.

4. Connect the data in the DAQmx read terminal to Time signal terminal of the FFT block.

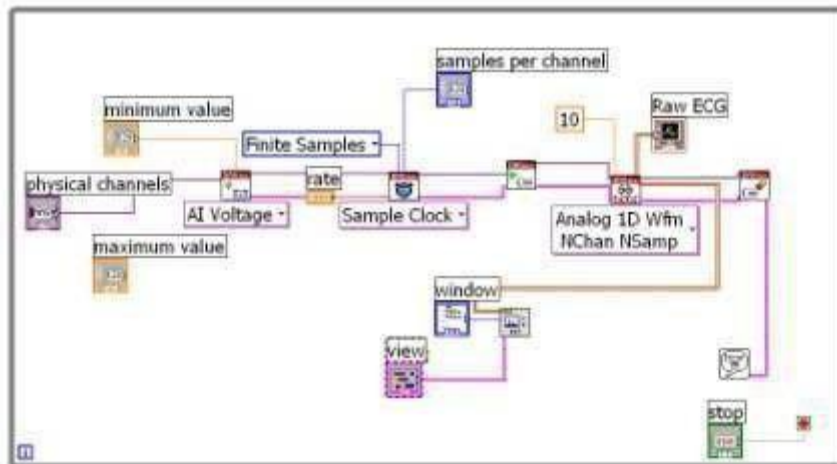


5. Configuring FFT block:

Keep the cursor over Window. Right click on it. A menu will pop up. Select Create → control.

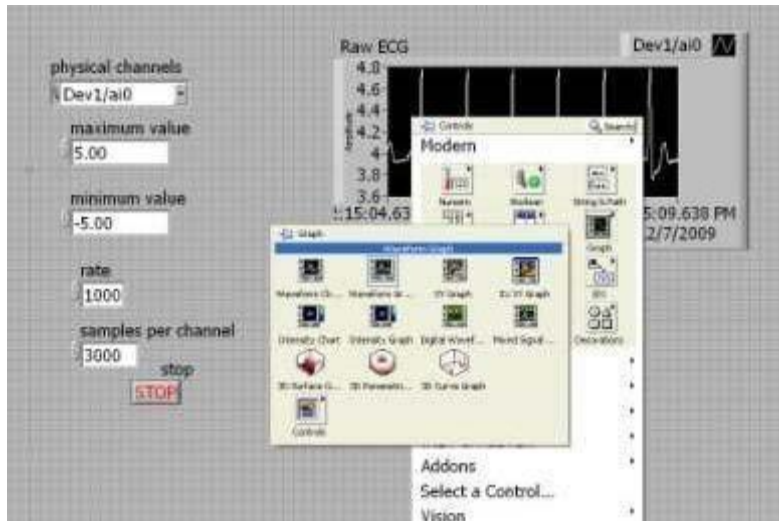


6. Similarly create a control for view.



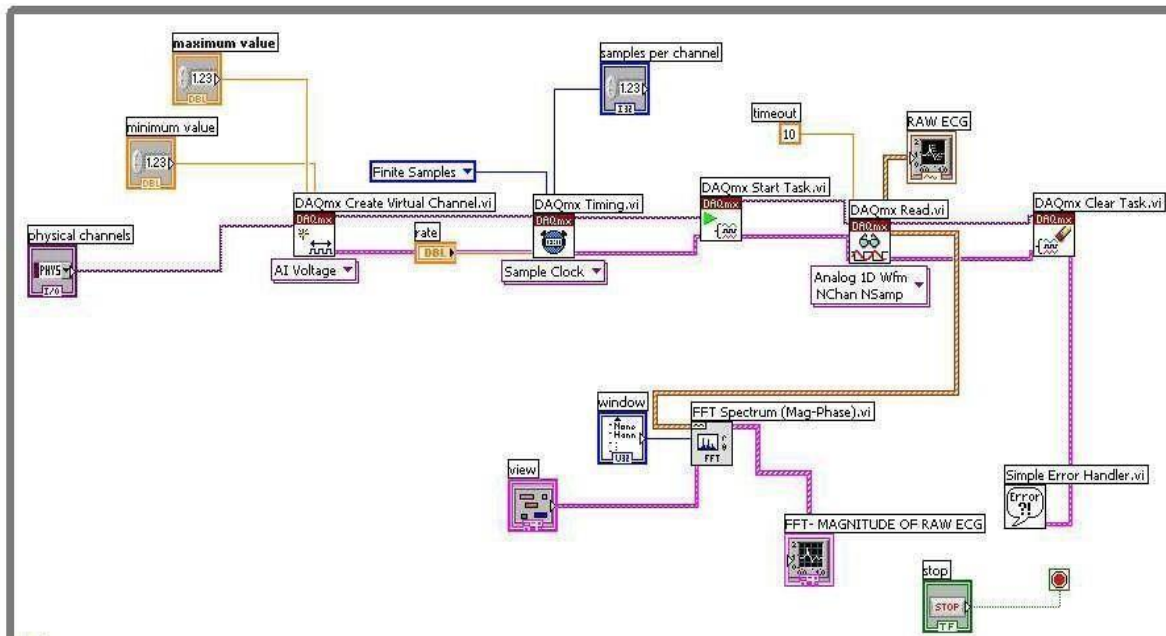
7. Displaying the FFT magnitude:

In the front panel do right click. Select Graph Waveform Graph. Place the Waveform Graph in the front panel.



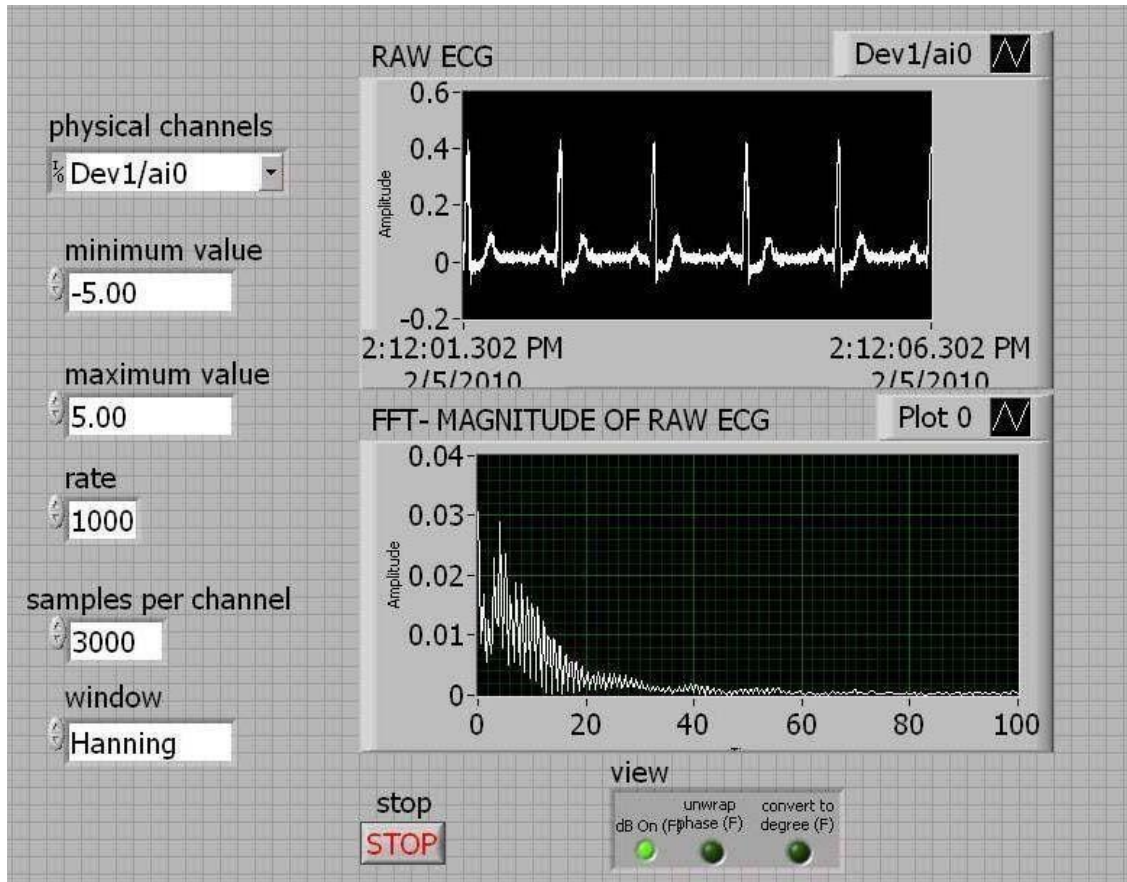
8. Connect the FFT magnitude terminal of the FFT block to the waveform Graph in the block diagram.
9. While running the application select **“_db On (F)”** in the view palette in the front panel. Select **Henning** window using the control in the front panel.

Final Block Diagram:

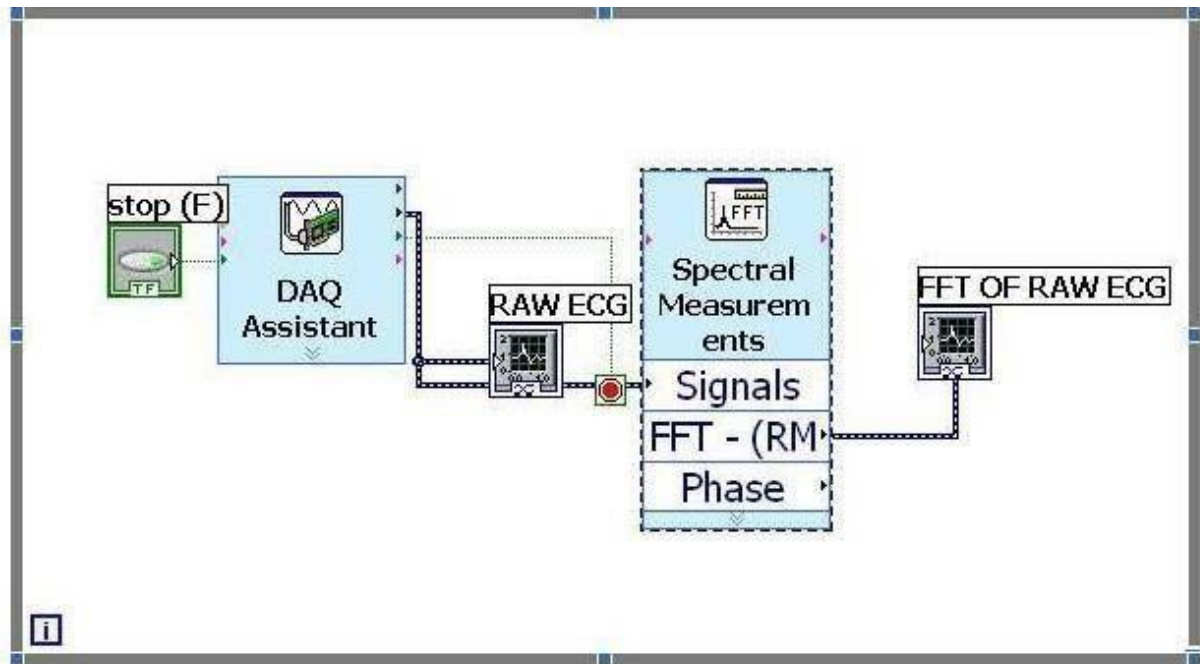


10. Save the program (CTRL + S). From the Front panel tool bar menu select Operate →Run (or press CTRL + R) to execute the program. The output is as shown in the figure.

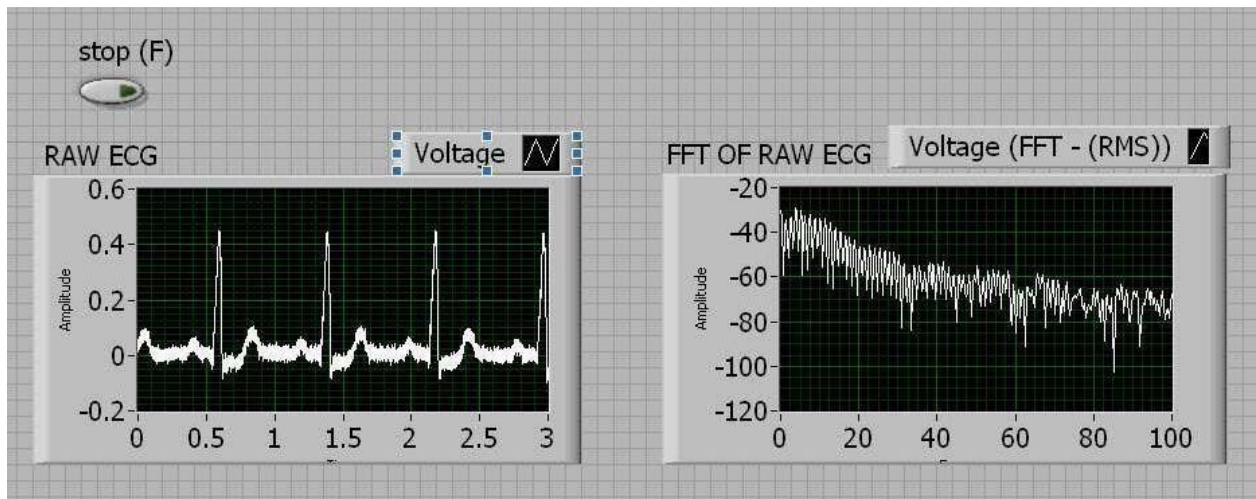
Final Front Panel:



Final Block Diagram:



Final Front Panel:



Result: Thus the raw ECG signal (0-40Hz) was acquired and its FFT was obtained. Power line interference occurred at 50Hz.

VIVA QUESTIONS:

1. What is a ECG signal?
2. What is the difference between the spectrum andCRO?