GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3170318
SUBJECT NAME: Virtual Instrumentation
7th SEMESTER

Type of course: Open Elective Course
Prerequisite: Basic understanding of Signal and Systems, Signal and Image Processing.

Rationale: This course introduces the Graphical system design (GSD), which is a modern approach to designing an entire system. Students will understand the benefits of graphical system design comprise reduced time to market, optimal system scalability, quick design iteration and increased performance at lower cost by studying this course.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Virtual Instrumentation: Historical perspective, advantages of VI, block diagram and architecture of a virtual instrument, Conventional Instruments versus Traditional Instruments, graphical programming in data flow, comparison with conventional programming.	5
2	VIs and sub-VIs, Error Checking and Error Handling, For and While loops, Shift Registers and Formula Nodes, Arrays and Clusters, Charts and Graphs, Case and Sequence Structures, Local and Global Variables, String and File I/O.	6
3	Introduction to Sensors and interfacing, Signal Conditioning, ADCs, DACs, Sampling, Noise and Filtering, Common Instrument Interfaces:4–20mA Current Loop, RS232, RS422 and RS485, GPIB, VISA, Interface Buses: USB, PCI, PXI.	8
4	Use of Analysis tools, Linear Algebra, Statistics and Curve Fitting, Fourier transforms, power spectrum, correlation methods, windowing and filtering, wavelet transform.	8
5	Application of VI in Biomedical: Biomedical Signal Acquisition and Analysis: Cardiovascular system, Respiratory system, Muscular System; Image acquisition and processing, Motion control.	5

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15%	25%	25%	20%	10%	05%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. S. Sumathi, P. Surekha, "LabVIEW Based Advanced Instrumentation Systems", Springer, 2007.
2. Robert H.Bishop, "LabVIEW 2009 Student Edition", Pearson College Division, 2009.
3. N.Mathivanan, "PC-based Instrumentation: Concepts and Practice", Eastern Economy Edition, PHI Learning private ltd ,2007.
4. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newnes, 2000.
5. Jovitha Jerome, "Virtual Instrumentation Using LabVIEW", Eastern Economy Edition, PHI Learning private ltd ,2010.

Course Outcomes:

After completion of this course students will be able to..

CO No	Course Outcomes	% Weightage
CO1	Understand the applications and advantages of VI over conventional instrumentation.	15%
CO2	Develop a software program called VI using various software modalities.	20%
CO3	Apply plug-in DAQ interfaces for prototype measurement systems.	25%
CO4	Analyze the responses from the systems using various analysis techniques.	25%
CO5	Identify various applications of VI modules for developing Biomedical measurement systems	15%

List of Experiments (Outline)

1. Understanding the graphical programming language.
2. Programming exercises for loops and charts
3. Programming exercises for clusters and graphs.
4. Programming exercises on case and sequence structures, file Input / Output.
5. Data acquisition through Virtual Instrumentation.
6. Developing voltmeter using DAQ cards.
7. Developing signal generator using DAQ cards.
8. Real time temperature measurement and control using Virtual Instrumentation.
9. Acquisition and analysis of sound level.
10. Acquisition and analysis of respiration rate, air flow and lung volumes.
11. Acquisition and analysis of Blood Pressure graphs.
12. Acquisition and analysis of ECG-Heartrate signal.
13. Acquisition and analysis of muscle activities and fatigue.
14. Image acquisition and processing using NI Vision toolkit.

Design based Problems (DP)/Open Ended Problem:
To design and develop mini project applications using sensors, actuators, development boards, communication peripherals, etc. to understand the ease and compatibility of developing VIs.

Major Equipment:
NI LABVIEW software