Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2020-21

Course Handout

16-01-2021

Course No. : *INSTR F419*
Course Title : Virtual Instrumentation
Instructor-in-Charge : Dr. Rajesh Kumar Tripathy

1. **Scope and Objective of the Course:**

This course provides the student an exposure to concepts in PC-based instrumentation including principles of graphic system design and concepts in data processing and time-frequency analysis using NI LabVIEW. The experiments in the laboratory are expected to consolidate and complement the learning in the lecture. In the laboratory, students are expected to use NI LabVIEW to develop complex virtual instruments by the end of the course.

2. Textbooks:

1. Jovitha Jerome, Virtual Instrumentation Using LabView, PHI Learning Private Limited, 2011

3. Reference books/Materials

1. Sanjay Gupta, Joseph John Virtual Instrumentation Using LabView, Tata McGraw Hill, 2nd edition, 2010.
2. Fawwaz T. Ulaby, Michel M. Maharbiz, Cynthia M. Furse, Circuit analysis and design, Michigan Publishing, 2018

4. Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1	Course details	Introduction to the Course	Handout itself
2-3	Virtual Instrumentation Fundamentals	Graphic system design, Design flow, The Virtual Instrument (VI), role of hardware and software, applications in test, control and design	T1 Ch. 1, class Notes
4-5	Introduction to LabVIEW	Creating a project, adding files, creating a VI, Front panel controls, Block diagram blocks, creating documentation	T1 Ch. 2.1-2.11, class Notes
6-7	Mathematical operations using LabView	Addition, subtraction, division, multiplication operations, performing mathematical expressions based on selection	Class notes
8-9	Random numbers and loop	Random number generation, for loop, stop executing the for loop after a certain condition, while loop, random number generation using for loop and while loop	T1 Ch.4.2,4.4,4.8, Class notes
10-11	Waveform generation	Sine wave, square wave, triangular wave and sawtooth	T1 Ch. 7, and

	using LabVIEW	wave generation, frequency and amplitude parameters, waveform graph	Class notes
12-15	Hybrid programming using LabView	MATLAB script in LabVIEW, generation of different signals using MATLAB script, convolution, correlation, addition, subtraction, division using LabVIEW	Class notes
16	Frequency domain analysis using LabVIEW	Spectral analysis using LabVIEW, plot magnitude and phase spectrum for various signals	Class notes
17-18	AM and FM signals generation using LabVIEW	AM signal generation, DSB-SC signal generation, FM signal generation, frequency domain analysis of AM and FM signals	Class notes
19	Measurement using LabVIEW	Measurement of parameters such as amplitude, frequency, negative peak, peak to peak amplitude, DC value of signal.	R1 and Class notes
20	Statistical analysis of LabVIEW	Statistical analysis of signal, mean, variance, kurtosis, skewness, and evaluation of histogram.	Class notes
21-22	Sorting and searching in an array using LabVIEW	Sorting elements in an array using LabVIEW in ascending and descending orders, searching an element in an array, delete an element at a specified location of an array.	R1 and Class notes
23	Read and write measurement files in LabVIEW	Basics of file I/O: open/close, read measurement file in LabVIEW, write measurement file in LabVIEW	T1, Ch. 9.7, 9.8,9.10, Class notes
24-25	Data processing using LabVIEW	Extract portion of a signal, append two dynamic signals, converting dynamic data to waveform data, converting waveform data to array, scaling operation, comparison of signals, evaluate peaks and valleys of a signal	Class notes
26-30	Filter design using LabVIEW	Evaluation of the transfer function of filter using LabVIEW, pole-zero gain equation, differential equation, filter specification parameters, low-pass, high-pass, band-pass, and band-reject filters using LabVIEW, design of filters using pole-zero method in LabVIEW	Class notes
31-32	Feature extraction using LabVIEW	Statistical features extracted from a signal using LabVIEW, frequency domain features of the signal using LabVIEW	Class notes
33-34	Time-Frequency analysis	Time-frequency analysis using LabVIEW, spectrogram of different signals	Class notes
35-38	LabVIEW applications: heart rate evaluation from ECG	Implementation of Pan Tomkin's algorithm for the evaluation of heart rate signal from ECG using LabVIEW, Detection of bradycardia and tachycardia from ECG signal using LabVIEW.	Class notes
39-42	Data acquisition (DAQ) system and LabVIEW	Getting Started with the my DAQ, Measurement Ports, NI ELVISMx Instrument Launcher, Measuring Voltage, Measuring Current, Using the NI my DAQ as a Current Source, Creating Waveforms with the Function Generator (FGEN), Measuring Frequency Response with the Bode Analyzer	R2, Appendix F

5. Evaluation Scheme:

Component	Duration	Weightage	Marks	Date	Remarks
Mid Sem exam	90 min	30%	90	01/03 3.30 - 5.00PM	OB
Lab assignments and report	During lab hours	35 %	105	During lab hours	OB
Comprehensive Exam.	2 hours	35 %	105	03/05 FN	OB

6. Chamber Consultation Hour: Through Google meet

7. Notices: Notices concerning this course will be on CMS.

8. Make–up Examination: Make-up will be given on genuine grounds only. Prior application should be made for seeking the make- up examination.

9. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Rajesh Kumar Tripathy
INSTRUCTOR-IN-CHARGE