DISCIPLINE SPECIFIC ELECTIVES (DSE) COURSES OFFERED BY THE DEPARTMENT

DISCIPLINE SPECIFIC ELECTIVE: Linear Integrated Circuits (INDSE4A)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical / Practice		
Linear Integrated Circuits(INDSE4A)	04	03	-	01	Class XII passed with Physics + Mathematics/Applied Mathematics+ Chemistry / Computer Science/Informatics	Understanding of Analog electronics & Operational Amplifiers

Learning Objectives

The Learning Objectives of this course are as follows:

- Familiarity and designing of various non-linear circuits using op-amp
- Familiarity and designing of multivibrators using 555 timer.
- Use of op-amp in designing of D/A and A/D convertors.
- Familiarity with different Linear ICs like 380, 555, 565, 566, 78xx and 79xx.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Design and explain the working of log & anti-log amplifier, analog multiplier and precision rectifier using op-amp.
- Design and explain the working of D/A and A/D convertors using op-amp.
- Design and explain the working of different types of multivibrators using IC 555.
- Use the regulator ICs for regulation purposes.

SYLLABUS OF DSE-2

UNIT – 1 **(12 hours)**

Sample and hold circuits, logarithmic amplifiers, antilogarithmic amplifiers, analog multipliers, Precision rectifier circuit: Half wave rectifier, full wave rectifier, bridge rectifier, peak rectifier, clipper, clamping, and applications of precision rectifier circuits.

UNIT – 2 **(12 hours)**

D/A convertor: Binary weighted resistors, R/2R resistor. A/D convertor: Successive approximation.

Power Amplifiers: Monolithic power amplifier (IC 380), use of power boosters (IC 3329/03), application of power amplifiers

UNIT – 3 **(12 hours)**

Multivibrators (IC 555): Pin and block diagram, Astable and monostable multivibrator circuit, applications of astable and monostable multivibrators.

Phase locked loops (PLL): Block diagram, operating principle, phase detector types, monolithic phase locked loops (IC565). Application of PLL IC 565: Frequency multiplier and frequency shift keying. Voltage controlled oscillator (IC 566).

UNIT – 4 **(9 hours)**

Voltage Regulators IC: Fixed voltage regulator (IC 78xx and IC 79xx), adjustable voltage regulator (IC 317 and IC 337), switching regulator (IC 1723) and special regulator.

Practical component: **(30 hours)**

1. Designing of precision half wave rectifier circuit.
2. Designing of precision full wave rectifier circuit.
3. Designing of precision positive and negative clipper circuit.
4. Designing of precision positive and negative clamper circuit.
5. Designing of binary weighted D/A convertor OR R/2R resistor D/A convertor
6. Design an astable multivibrator using IC 555.
7. Design a monostable multivibrator using IC 555.
8. Design a voltage regulator circuit using voltage regulator IC.

Essential/recommended readings

1. Skoog &Lerry, Instrumental Methods of Analysis, Saunders College R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education 4th Edition, May 2015.

2. R. F. Coughlin and F. F. Driscoll, Operational amplifiers and Linear Integrated circuits, Pearson Education (2001).
3. J. Millman and C.C. Halkias, Integrated Electronics, Tata McGraw-Hill, (2001).
4. A.S. Sedra and K.C. Smith, Microelectronics Circuit, Oxford (2011).

Suggestive readings

1. A.P.Malvino, David J Bates, Electronic Principals, 7th Edition, Tata McGraw-Hil Education, (July 2017).

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE: Statistical Tools and Techniques (INDSE4B)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Statistical Tools and Techniques (INDSE4B)	04	03	-	01	Class XII passed with Physics + Mathematics/Applied Mathematics/Biology+ Chemistry / Computer Science/Informatics	Class X Mathematics

Learning Objectives

The Learning Objectives of this course are as follows:

- To develop the students' ability to deal with numerical and quantitative issues in industries.
- To enable the use of statistical, graphical, and algebraic techniques wherever relevant.
- To have a proper understanding of Statistical applications in different fields.
- To identify and discuss critically, the uses and limitations of statistical analysis.

Learning Outcomes

The Learning Outcomes of this course are as follows:

- Describe and discuss the key terminology, concepts tools, and techniques used in statistical analysis
- Understand the concept of probability and sampling distributions

- Perform different parametric and non-parametric tests for various statistical analysis.

SYLLABUS OF DSE-02

Descriptive statistics: Graphical and Tabular representation of data. Measures of Central Tendency, Measures of Dispersion, Measures of Skewness and Kurtosis.

Unit-1 **(13 hours)**

Correlation and Regression: Linear Regression and Correlation.

Unit-2 **(12 hours)**

Probability and Distributions: Introduction to probability, Experiment, sample space, event, probability, conditional probability, Baye's Theorem, Random Variables, Probability Distributions- Normal, Binomial, Poisson, Mathematical Expectation.

Unit-3 **(10 hours)**

Sampling and Sampling Distributions: Sampling distributions and Standard errors. One and two-sample estimation of means and proportions. One and two-sample tests of hypothesis- means, proportions and variances, t-test, Chi-square test.

Unit-4 **(10 hours)**

Nonparametric Statistics: Nonparametric tests, Sign test, Signed-Rank test, Rank-Sum test, Kruskal-Wallis test, Runs test.

Practical component: **(30 hours)**

1. Collection, tabulation, and statistical interpretation of data.
2. To study measures of central tendency- mean, median, mode.
3. To study measures of dispersion- range, standard deviation, variance.
4. To study the coefficient of variation.
5. To study measures of skewness.
6. To study the continuous and discrete distribution.
7. To study nonparametric tests.

Essential/recommended readings

1. Probability and Statistics for Engineers and Scientists by Walpole, Myers, Myers and Ye, 9th Edition, Pearson Education, 2012.
2. Mathematical Statistics and Applications by John E. Freund, 8th Edition, Prentice Hall, India, 2014.
3. Introduction to Statistical Quality Control by Montgomerry, 8th Edition, John Wiley and Sons, 2019.

Suggested Books:

4. Principles of Biostatistics by M. Pagano and K. Gauvrean: Thompson learning (2nd edition); 2018.
5. Biostatistics: A Foundation for Analysis in the Health Sciences by W. W. Daniel and Chad L. Cross; John Wiley and Sons Inc (11th edition); 2018 .

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DISCIPLINE SPECIFIC ELECTIVE: Virtual Instrumentation (INDSE4C)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Virtual Instrumentation Techniques and Applications (INDSE4C)	04	02	-	02	Class XII passed with Physics + Mathematics/Applied Mathematics+ Chemistry / Computer Science/Informatics	Electronic Instruments & programming language

Learning Objectives

The Learning Objectives of this course are as follows:

- To understand the importance of Virtual Instrumentation and study its applications.
- To learn the basic programming concepts in LabVIEW.
- To understand the basics of data acquisition for designing a Virtual Instrument.
- To recognize the various building blocks of Virtual instrumentation and use them for PC-based Measurement.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Understand the importance and applications of Virtual Instrumentation.
- Learn the basic programming concepts in LabVIEW.
- Recognize the components of Virtual instrumentation and use them for PC Based Measurement.

SYLLABUS OF DSE-02

Unit 1 **(6 hours)**

Introduction to Virtual Instrumentation: Historical perspective, advantages, Block diagram and Architecture of a Virtual Instrument, Data Flow Techniques, Graphical programming in the data flow, comparison with Conventional programming.

Unit 2 **(10 hours)**

LabVIEW Programming Environment: Basic operations, Controls/ Indicators, Auto indexing, Debugging, Timing issues (counters).

VI Programming Techniques: Modular programming: VIS and sub-VIS, loops, Arrays, Clusters, Graphs, Charts, Case & Sequence structures. Formula nodes, Local and Global variables, String & file input.

Unit 3 **(10 hours)**

Instrument Control: GPIB Communication, Instrument I/O Assistant, Virtual Instrument Software Architecture (VISA), Instrument Drivers, Serial Port Communication

Data Acquisition Basics: Signals Handling and Classification, Signal Conditioning, Analog Interfacing (I/O), Counters & Timers, Digital (I/O) - DAQ Hardware, DAQ Software Architecture, DAQ Assistant

Unit 4 **(4 hours)**

Developing applications on LabVIEW: Process control, Waveform generator, Motion control using a stepper motor.

Practical Components **(60 hours)**

1. The length and breadth of a rectangle and the radius of a circle are inputs. Build a VI to calculate the area and perimeter of the rectangle and the area and circumference of the circle.
2. Convert a binary number to a decimal number.
3. Compute the equations (X1 + 2)*3 and 5 + X2*log(X2) using functions, Expression node, and Express Formula for the given inputs X1 and X2.
4. Build a VI to find the factorial of a number.
5. Create a VI to find the sum of first n natural numbers using a While Loop with a feedback node.
6. Write a program in LabVIEW to read a positive number n and to generate the following number series using (a) a For Loop and (b) a While Loop
   1, 22, 32, 42, …, n2
   0, 2, 4, 6, …, n
7. Create a VI to compare the element of two clusters if the value of the corresponding element is the same switch on LED in the output cluster.
8. Build an array of cluster controls in which each cluster consists of a numeric control and a 1D numeric array (with 5 elements). This forms a database of marks of students. The numeric control indicates the roll number and the array indicates the test marks of five subjects. Build logic to modify the mark in a particular subject of a particular student. Input the roll number, the subject in which the mark is to be changed, and the new marks. Display the changed database on a separate array indicator.
9. Create a 1D numeric array that consists of ten elements and rotate it ten times. For each rotation display the equivalent binary number of the first array element in the

form of a Boolean array. Also, display the reversed Boolean array. Provide delay to view the rotation.

10. Create two 2D numeric arrays and add them. Change the number of rows and number of columns of each array and see the result.
11. Create a 1D array and find its reverse.
12. Build a VI to plot a circle in the XY graph using a For Loop.
13. Build a VI that generates a 1D array of random numbers and sort the ascending descending array and also find the max. and min. value array element.
14. Build a cluster control that consists of a seven-segment LED display, a switch, a string control, and numeric control. Split the cluster elements using the Unbundle function and alter the values of some of the cluster controls. Bundle them again and display them in a cluster indicator.
15. Using a for loop determines the number of odd numbers between a range of numbers entered by the user.
16. Write a for loop which takes the given values of u from a numeric control labeled coefficient of kinetic friction. Calculate f‟ from theta=0 to 90 degree in 1-degree increment then display the resulting array f‟ values on a waveform graph.
17. Create a VI to check whether the cluster elements are in range or not. Specify the upper and lower limits. Display the coerced output and a cluster of LEDs to indicate whether a particular cluster element is in the range or not.
18. Split an input string into two outputs with reference to a separating character. Find the length of the input string and reverse the string.
19. Write a program to solve x2+bx+c=0.
20. Build a VI to generate two waveforms of different amplitude and frequency add the signal to find the resultant and plot it on the separate waveform graph.

Essential/recommended readings

1. John Essick , Hands-on Introduction to LabVIEW for Scientists and Engineers, 3rd Edition, 2015.
2. Gary Johnson, LABVIEW Graphical Programming, McGraw Hill, 4th Edition, 2006.
3. Lisa K. Wells and Jeffrey Travis, LABVIEW for Everyone, PHI, 3rd Edition, 2006.
4. James K, PC interfacing and data acquisition, 2002.
5. Skolkoff, Basic concepts of LABVIEW 4, PHI, 1998.

Suggested Books

1. Technical Manuals for DAS Modules of Advantech and National Instruments. L.T. Amy, Automation System for Control and Data Acquisition, ISA, 4thEdition, 1992.
2. S. Gupta, J.P. Gupta, PC Interfacing for Data Acquisition and Process Control, ISA, 2nd Edition, 2nd Edition, 1994.

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