Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Detailed Syllabus

For M.Sc. Electronic Science

(2019-20 Course)

(with effect from 2019-20)

CIA: Continuous Internal Evaluation

Semester 1 (Part 1)

Course Type	Course Code	Course / Paper Title	Hours / Week	Credit	CIA	End Sem Exam	Total
CCT-1	19ScEleP101	Analog Circuit Design and Analysis	03	03	50	50	100
CCT-2	19ScEleP102	Mathematical Methods and Network analysis.	03	03	50	50	100
CCT-3	19ScEleP103	Foundation of Semiconductor Devices and Circuits	03	03	50	50	100
CCT-4	19ScEleP104	Advanced 'C' Programming	03	03	50	50	100
CCP-1	19ScEleP105	Hardware Practical	03	03	50	50	100
CCP-2	19ScEleP106	Software Practical	03	03	50	50	100
SECP-1	19ScEleP107	Printed Circuit Board Designing	02	02	50	50	100
AECCT-1	19CpCysP101	Cyber Security-I	1	1	-	-	25
AECCT-2	19CpHrtP102	Human Rights-I	1	1	-	-	25
		Total Credits	-	**22**			

Semester 2 (Part 1)

Course Type	Course Code	Course / Paper Title	Hours / Week	Credit	CIA	End Sem Exam	Total
CCT-5	19ScEleP201	Linear Integrated Circuit	03	03	50	50	100
CCT-6	19ScEleP202	Digital System Design	03	03	50	50	100
CCT-7	19ScEleP203	RF & Microwave Technology	03	03	50	50	100
CCT-8	19ScEleP204	Instrumentation System	03	03	50	50	100
CCP-3	19ScEleP205	Hardware Practical	03	03	50	50	100
CCP-4	19ScEleP206	Software Practical	03	03	50	50	100
SECP-2	19ScEleP207	Virtual Instrumentation	02	02	50	50	100
AECCT-3	19CpCysP201	Cyber Security-I	1	1	-	-	25
AECCT-4	19CpHrtP202	Human Rights-I	1	1	-	-	25
		Total Credits	-	**22**			

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP101
Course Name: Analogue Circuit Design

Teaching Scheme: TH: 3Hours/Week **Credit: 03**

Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Fundamental working principle of electronic Devices.
- Student must have knowledge of frequency response of devices.
- Knowledge of feedback concept.

Course Objectives:

- To learn the characteristics and working of electronic devices.
- To study the wideband and narrowband amplifiers using BJT.
- To develop skills in analysis and design of analog circuits.
- To study and design oscillator circuits.

Course Outcomes:

On completion of the course, student will be able to–

- Understanding of operation of p-n junction diode with its small and large signal models with its terminal characteristics and derivation of diode equation.
- Understanding of physical structure of Bipolar junction transistor with operation in various modes of operation with derivation of collector current equation.
- Understanding of physical structure of JFET and MOSFET with operation, and both T type and π type of models.
- Understand the frequency response of BJT amplifiers. Understand the functioning of transistor in low and high frequency region.
- Understand the feedback concepts and construct feedback amplifiers and oscillators. Also summarizes its performance parameters.

Course Contents:

Chapter 1	Basic Semiconductor Devices	15 lectures
	Diode: Practical diode characteristics (static and dynamic resistance), temperature effects, switching characteristics, diode breakdown, diode applications in wave shaping circuits. **BJT:** construction, biasing and operation, CC, CB and CB configurations. **UJT:** construction, working principle, I-V characteristics, Specifications parameters of Uni-Junction Transistor (UJT). **JFET:** Construction, types and operation, characteristics, parameters of JFET, comparison of BJT and JFET, JFET amplifiers. **MOSFET:**depletion& enhancement, biasing of MOSFET, applications.	
Chapter 2	Biasing, Small Signal and Frequency Response	15 lectures
	Small Signal Analysis of BJTs: Small-Signal Equivalent-Circuit Models; Small Signal Analysis of CE, CC, CB amplifiers. Effects of RS and RL on CE amplifier operation, Emitter Follower; Cascade amplifier, Darlington Connection and Current Mirror Circuits. **Small Signal Analysis of FETs:** Small-Signal Equivalent-Circuit Model, Small Signal Analysis of CS, CD, CG Amplifiers. Effects of RSIG and RL on CS Amplifier; Source Follower and Cascaded System. **High Frequency Response of FETs and BJTs**: High Frequency equivalent	

	models and frequency Response of BJTs and FETs; Frequency Response of CS Amplifier, Frequency Response of CE Amplifier. Frequency response of multistage amplifiers, different coupling schemes and gain of multistage amplifiers.	
Chapter 3	Tuned Amplifier and Oscillators	15 lectures
	Tuned amplifier design, multistage tuned amplifiers: synchronous and stagger tuning cascade configuration, large signal tuned amplifier. **Oscillators:** concept of feedback**,** design and analysis of LC and RC oscillators, Hartley, Colpitts, Miller oscillators, phase shift and Wien-bridge oscillators, and applications. Non sinusoidal oscillator: crystal oscillators, oscillator using IC 555 and its application, Relaxation oscillator using UJT.	
	Total Lectures	**45**

Text / Reference Books:

- **Electronic Devices and Circuit Theory**, *by Robert Boylestead, Louis Nashelsky, PHI*.
- **Grob's Basic Electronics,***by Mitchel E. Schultz 11e McGraw Hill*
- **Design with Operational Amplifiers and Linear IC**, *by Sergio Franco, 3rd Edn, TMH.*
- **Electronic Principles**,*by Malvino and Bates, McGraw Hill.*
- **Operational Amplifier,***by G.B. Clayton, Elsevier Sci. Tech.*
- **Microelectronic Circuits, Analysis and Design,***by Mohammad H. Rashid, PWS Publishing*
- **Microelectronic Circuit,***by Sedra Smith, 6e oxford university press.*

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP102
Course Name: Mathematical Methods and Network Analysis

Teaching Scheme: TH: 3Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**
Prerequisite Courses:

- Fundamental Mathematical Tools.
- Fundamentals of Electrical Engineering and Mathematics

Course Objectives:

- To learn concept of mathematical modeling of simple electrical circuits.
- To study mathematical tools and techniques for network analysis.

Course Outcomes:

On completion of the course, student will be able to–

- Know the concepts of Modeling and its Types.
- Know the concepts of Laplace Transforms and its application to solve Differential Equations.
- To understand the basic concepts of AC & DC circuits.

Course Contents:

Chapter 1	Mathematical Modeling, Systems and Signals	15 lectures
	• **Mathematical modeling** Concept of modeling, types, mathematical modeling using differential equations, transfer function. Signal flow method, state variable method with simple examples, analogous physical and electrical quantities. • **Signals** Periodic, aperiodic, Continuous Time (CT) and Discrete Time (DT), special electronic signals (impulse, unit step, sinusoidal, ramp, square wave, staircase).	
Chapter 2	Laplace Transform Mathematical Tools for Circuit Analysis	15 lectures
	Laplace TransformDefinition, LT of standard electronic signals, inverse LT, methods of ILT (partial fraction method), properties of LT (shifting, linear, scaling), initial and final value theorem, LT of derivatives and integrals, solution of DE using LT, concept of Transient and steady state response. Laplace transformation of electrical circuits, two port network functions, time and frequency domain response of systems using transfer function, poles and zeros of transfer function and their significance, applications to simple passive filters such as Low Pass (LP), High Pass (HP), Butterworth filters, stability criterion, Routh-Hurwitz criterion, synthesis of transfer function using poles and zeros.	
Chapter 3	Network Analysis	15 lectures
	Network Topology (nodes, tree, graph, branch, mesh, and loop) Network Theorems and Applications to DC and AC Circuits: Thevenin's, Norton's, superposition, maximum power transfer theorems Mesh, loop and nodal analysis of circuits, T and π networks, Attenuators, equalizers, series and shunt equalizers.	
	Total Lectures	**45**

Text / Reference Books:

- **Advanced Engineering Mathematics,***by E. Kreyzig, John Wiley and Sons.*

- **Signals, Systems, And transforms, 4ed,***by Charles L. Phillips, John M. Parr, Pearson Prentice Hall*
- **Network Analysis,***by G. K. Mittal, Khanna Publication.*
- **Fundamentals of Signals and Systems,***by Benoit Boulet, Charles River Media*
- **Circuits and Networks Analysis and Synthesis,***by A. Sudhakar, Shyam Mohan and Pilli, TMH.*
- **Digital Signal Processing,***by S. Salivahan, A. Vallavraj and C. Gnanpriya, McGraw Hill.*
- **Network Analysis,***by M. E. Van Valkenberg, PHI.*
- **Network and Systems,***by Roy Choudhary, Wiley Eastern.*

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP103
Course Name: Foundation of Semiconductor Devices and Circuits

Teaching Scheme: TH: 3Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Fundamentals of semiconductor devices.

Course Objectives:

- To provide an understanding of the characteristics of semiconductor devices.
- To introduce concept device simulators.
- To introduce quantum & statistical mechanics.
- To introduce theory of diode, transistor & FET from semiconductor physics point of view.
- To study and understand energy band diagram of devices.

Course Outcomes:

On completion of the course, student will be able to–

- Learn the important concepts related to semiconductor technology.
- Perform the analysis and design of semiconductor devices (electrostatics and current-voltage characteristics) from fundamental principles.
- Learn how to extract device parameters by suitable experiments.
- Learn the fundamentals of circuit design and observe how device properties and device design impact circuit behavior (e.g. dc and ac response, noise)

Course Contents:

Chapter 1	Theory Of Quantum And Statistical Mechanics	15 lectures
	Introduction to Quantum Mechanics: Principles of quantum mechanics, Schrodinger wave equation, and Applications of Schrodinger's wave equation for bound state potential problems. Introduction to quantum theory of solids: Allowed & forbidden energy bands, electrical conduction in solids, extensions to three dimensions, density of states, Statistical mechanics: Statistical laws, Fermi-Dirac probability function, the distribution function and the Fermi energy.	
Chapter 2	Physics of Semiconductors	15 lectures
	Semiconductor in equilibrium: Charge carriers in semiconductors, dopant atoms and energy levels, extrinsic semiconductors, Statistics of donors and acceptors, charge neutrality, position of Fermi energy level. **Carrier transport phenomena**: – charge, effective mass, state & carrier distributions, Carrier drift, carrier diffusion, graded impurity distribution, resistivity,the Hall effect. **Non-equilibrium excess carriers in semiconductors**: Carrier generation and recombination, characteristics of excess carriers, ambipolar transport, quasi-Fermi energy levels, excess carrier lifetime, surface effects.	
Chapter 3	Junction Devices	15 lectures
	Overview of construction of diode and transistor **BJT**: Terminology, electrostatics and performance parameters, Eber-Moll model, two port model, hybrid – pi model, device models in spice, Modern BJT structures – polysilicon emitter BJT, Heterojunction bipolar transistor (HBT). **FET**: JFET and MESFET: Junction terminologies, characteristics, ac response, spice models.	

	MOSFET: Fundamentals,Electrostatics-, Capacitance- voltage characteristics. I-V characteristics: Qualitative Theory of Operation, ID - VD Relationship, A.C. response, spice models. **Poly-Junction Devices:**SCR, DIAC, TRIAC. **Optoelectronic Devices**: Photodiodes- p-n and pin, LEDs, Laser diodes.	
	Total Lectures	**45**

Text / Reference Books:

- **Semiconductor Physics and Devices Basic Principles,***by Donald A. Neamen, TMH, 4th Edition (2003).*
- **Principles of Semiconductor Devices***,bySimaDimitrijev, 2e, Oxford University Press.*
- **Semiconductor Device fundamentals,***by Robert F. Pierret, Pearson Education*
- **Solid State Electronics Devices,***by Streetman, PHI, 5th Edition, (2006)*
- **Semiconductor Device Physics and Design,** *by Umesh K. Mishra, Jasprit Singh, Springer Publication*
- **Semiconductor Physical Electronics,***by Sheng S. Li, 2e Springer Publication*

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP104
Course Name: Advanced 'C' Programming

Teaching Scheme: TH: 3Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Fundamentals of Computer.

Course Objectives:

- To Study basic concepts of C programming language.
- To learngraphics programming and computer hardware interfacing.

Course Outcomes:

On completion of the course, student will be able to–

- design programming solution for mathematical and electronics problems.
- design graphical solutions for electronics problem.
- access hardware ports of computer to control external world.

Course Contents:

Chapter 1	Introduction to C Language	15 lectures
	• **Introduction to Programming Languages** Evolution of programming languages, basic structure of C program, the compilation process, object code, source code,executable code, operating systems, interpreters, linkers, loaders, fundamentals of algorithms, flow charts. • **C Language Fundamentals** Character set, Identifiers, Keywords, Data Types, Constant and Variables, Statements, Expressions, Operators, Precedenceof operators, Input-output Assignments, Control structures, Decision making and Branching, Decision making & looping.	
Chapter 2	Concepts of C Programming	20 lectures
	• **C Functions** User defined and standard functions, Formal and Actual arguments, Functions category, function prototypes, parameter passing, Call-by-value, Call-by-reference, Recursion, Storage Classes. • **Arrays and Strings** One dimensional Array, Multidimensional Array declaration and their applications, String Manipulation. • **Pointers** Pointer variable and its importance, Pointer Arithmetic, passing parameters by reference, pointer to pointer, linked list, pointers to functions, dynamic memory allocation. • **Structures, Unions** Declaration of structures, declaration of unions, pointer to structure & unions. • **File Handling** Console input output functions, Disk input output functions, Data files.	
Chapter 3	Advanced Features of C Programming	10 lectures

	• **C Graphics** Graphics driver, Graphics mode, DETECT macro, screen resolution, Library functions for C graphics programming. • **Hardware interfacing using c** Data Communication System, Data Terminal Equipment, Data Carrier Equipment, PC Parallel port interface, PC Serial RS232 port interface, interrupt {INT86()}, Mouse interface.	
	Total Lectures	**45**

Text / Reference Books:

- **Programming in C,***by E Balaguruswamy BPB*
- **Computer Programming in C**, *by V. Rajaraman, Pearson Education, 2nd edition, 2003.*
- **The C programming language,***by Dennis Ritchie, Pearson Education, 2nd edition, 2003.*
- **Graphics Programming in C**, *by Roger T. Stevens, BPB Publications.*
- **Programming with C,***by Byron S. Gottfried, Schaum Outline Series, Tata McGraw-Hill.*
- **Programming in C,***by Stephen G. Kochan. CBS.*

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First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP105
Course Name: Hardware Practical

Teaching Scheme: PH: 4Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Course objectives:

- To study BJT characteristics and Amplifiers.
- To study JFET Characteristics and Amplifiers.
- To study MOSFET Characteristics and Amplifiers.
- To study RC-Phase shift, Hartley, Colpitts and Crystal Oscillators

Course outcomes:

Through this course, the students:

- Acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier.
- Develop the ability to analyze and design analog electronic circuits using discrete components.
- Observe the amplitude and frequency responses of common amplification circuits.
- Design, construct, and take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis.

A. PracticalBased onAnalogue Circuit Design:

1 To determine and plot the characteristic of light emitting diode in forward bias region and compare between different color diodes.

2 Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).

3 To study transistor dc biasing circuits.

4 Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain bandwidth product from its frequency response.

5 Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.

6 Tuned amplifier small signal / large signal for IF.

7 Transistor based microphone amplifier.

8 Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation. a) Hartley Oscillator (b) Colpitts Oscillator.

9 Designing and implementation of Astable and Monostable multivibrator using LM555.

10 Design, implementation and study parameters of78xxregulated power supplies

B. Practical Based On Mathematical Methods

1 Verification of Thevenin's Theorem and maximum power transfer theorem for DC circuit.
2 Characteristics of Series and Parallel Resonant Circuits.
3 Step and frequency response of series LCR circuits.
4 Determination of circuit parameters: Open Circuit and Short Circuit parameters.

C. Practical Based On Semiconductor Devices

1 Common Emitter / Common Base input-output Characteristics
2 Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.

3 Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
4 Study of V-I characteristics of SCR, TRIAC and DIAC.
5 Study Conductivity measurement using four probe method
6 Study of Hall effect
And / or experiments of similar kind

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First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP106

Course Name: Software Practical

Teaching Scheme: PH: 4 Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Course Objectives:

- To get ability to solve problem based on basic C programming language.
- To get ability to solve problem based on hardware interfacing to PC.
- To get ability to solve problem based on C graphics.
- To get ability to design circuit using Multisim.

Course Outcomes:

On completion of the course, student will be able to–

- design programming solution for mathematical and electronics problems.
- design graphical solutions for electronics problem
- access hardware ports of computer to control external world.

A. Practical based on basic C programing concepts

1. Implementation of bubble sort/selection sort/merge sort/ insertion sort/ quick sort/ heap sort technique.
2. Implementation of linear search/ binary search methods.
3. Implementation of Stack, Queue, Link list.
4. Program to compare two strings using function and pointer, do not used library functions.
5. Program to concatenate 2 strings using pointers. Donot use library function.
6. Recursive functions - Factorial of a number, Fibonacci Series.
7. Prime numbers generation.
8. Give necessary declarations for an array of 20 voter records, each recordof which consists of four data values viz. Id-no, name, address, age. Makeuse of above declarations to write a programsegment that prints id-no.,name for all those voters whose age exceeds 60. (Assuming suitable datatypes.)
9. Write a program to count the number of characters, spaces, tab, newlines in a file.
10. Write a program to receive some strings from keyboard and print it to afile.
11. Write a program to read all the strings from file and print it on screen

B. Practical based on Hardware interfacing

a. Computer Mouse

1. Program to handle computer mouse
    - Program to find whether mouse driver is loaded or not.
    - Program to show/hide the mouse pointer.
    - Program to print which mouse button is pressed.
    - Program to set the position of the mouse pointer on the screen.
2. Program to do Free-hand drawing using mouse.

b. Computer Parallel Port (LPT)

3. Program to access parallel port of Computer to ON/OFF AC light.
4. Program to read DAC result via parallel port.
5. Program to apply digital input to ADC via parallel port.

c. Computer Serial Port (COM)

6. Program to connect two computers through the serial port and display whatever is typed on one computer on the other computer.
7. Program to interface Alphanumeric 16x2 LCD via parallel port of PC
8. Program to read RFID tag information, RFID reader interface to COM port of PC

C. Practical based on C Graphics

1. Basic Graphics examples
    a. Program to switch to graphics mode.
    b. Program to Line drawing using mouse.
    c. Program to display different symbols of electronic components.
2. Program to display IV characteristic of diode.
3. Program display the "HELLO" at 34,54 position using int86() function.

D. Practical based on Multisim

1. Study of D.C. analysis network circuits using Multisim.
2. Study of transient and AC analysis: Rectifiers, clippers and Clamper.
3. Study of Frequency response of single stage and multistage RC coupledamplifier.
4. Design and simulate BJT bias circuit and compare the results.
5. Design and simulate JEET/MOSFET bias circuit and compare the results.
6. Design and simulate JFET/MOSFET common-emitter circuit and compare D.C. and A.C. performance
7. Study of Voltage and Current Time base circuits (Bootstrap generator)
8. Study of Double and Stagger tuned Amplifiers
9. Phase shift, Hartley, Colpitt and Wien bridge oscillators using transistor (any two)

Progressive Education Society's

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First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP107
Course Name: Printed Circuit Board Designing

Teaching Scheme: HH: 2Hours/Week **Credit: 02**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Knowledge of Electronic Components.
- Basics of analog and Digital electronics.
- Identification of circuits.

Course Objectives:

- To Study designing of schematics
- To Study designing of PCB for schematics.

Course Outcomes:

On completion of the course, student will be able to–

- design various types of schematics and their simulations.
- design single layer and multi-layer PCB.

Semester I

Course Contents:

Chapter 1	Introduction to PCB Designing Concepts	10 lectures
	• **Introduction** What is PCB, Difference between PWB and PCB, Types of PCBs: Single Layer, Multi-Layer, PCB Materials, Older PCB Method, PCB Designing Using Graph Paper, making a hand drawn PCB, Using Computer for EDA, Brief History of EDA, Latest Trends in Market, how it helps and Why it requires, Different EDA tools, Introduction to circuit simulation software. • **Component introduction and their categories** ***Through Hole Packages:*** Axial lead, Radial Lead, Single Inline Package(SIP), Dual Inline Package(DIP), Transistor Outline(TO), Pin Grid Array(PGA). ***Surface Mount:*** Metal Electrode Face (MELF), Leadless Chip Carrier (LCC), Small Outline Integrated Circuit (SOIC), Quad Flat Pack (QPF) and Thin QFP (TQFP), Ball Grid Array (BGA), Plastic Leaded Chip Carrier(PLCC).	
Chapter 2	Lab Practice and Designing Concepts	20 lectures

	• **Introduction of Schematic software's for Schematic Entry** Brief Introduction of various simulators, Hands on practice on available library of components, working through wiring and schematic designing, Making New Component Symbols. • **Introduction of PCB Design software for PCB Designing** Selecting the Components Footprints as per design, Picking and placing the Component, Making New Footprints, Assigning Footprint to components. Detailed description and practical of PCB designing. • **PCB Designing Flow Chart:** Schematic Entry, Net listing, PCB Layout Designing, Prototype Designing, Design Rule Check(DRC), Design for Manufacturing(DFM), PCB Making, Printing, Etching, Drilling, Assembly of components. • **Description of PCB Layers:** Electrical Layers, Top Layer, Mid Layer, Bottom Layer, Mechanical Layers, Board Outlines and Cutouts, Drill Details, Documentation Layers, Components Outlines, Reference Designation, Text.	
	Total Lectures	**30**

Text / Reference Books:

- **Complete PCB Design Using OrCAD Capture and Layout,** by *Kraig Mitzner*.
- **EMC and The Printed Circuit Board**,*by Mark I. Montrose*
- **Printed Circuits Handbook**, *by Clyde F. Coombs, Jr.*

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP201

Course Name: Linear Integrated Circuit and Design

Teaching Scheme: TH: 3Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Ability to read datasheet of IC
- Insight of Internal Structure and parameters of Operational Amplifier
- Basis knowledge of dc power supply

Course Objectives:

- To study Op-Amp and its applications.
- To study power supply regulator ICs.
- To study data convertors.

Course Outcomes:

On completion of the course, student will be able to–

- Understand the basic op-amp circuit building blocks and understand their limitations due to non-ideal parameters of the op-amp
- Understand the use of op-amp in saturation as a comparator, zero crossing detector, astable multivibrators and monostable multivibrator
- Understanding of various circuits like analog to digital and digital to analog convertors.

Course Contents:

Chapter 1	Op-Amp Fundamentals and Its Applications	25 lectures
	Ideal characteristics of Op amp, Basic op-amp configurations, Ideal closed loop characteristics, Ideal op-amp circuit analysis. Transistor current sources and active loads, use of these in biasing of internal stages of op-amp, supplyindependent biasing and temperature independent biasing, Low current biasing, Matching considerations in transistor current sources. Emitter coupled differential amplifier, source-coupled FET pairs, Device mismatch effects. Frequency response of single and multistage amplifiers Internal circuit of IC 741, Feedback and its effect on amplifier parameters, Practical considerations and effect of loading. Characteristics of practical op-amps (static and dynamic) i.e. DC and low frequency parameters as well as large signal and transient characteristics. Inverting and non-inverting amplifiers, Integrators and Differentiators Instrumentation and bridge amplifiers, Log and antilog amplifiers, Active filters, (Butterworth Chebyshev designs first and second orders), Sample and Hold circuits, Precise rectifiers and peak detectors, Comparator Circuits, Voltage references and regulators, PLL. (Application of opamp:- Tutorial Form).	
Chapter 2	Regulated Power Supply	10 lectures
	Voltage regulators: Performance parameters (line regulation, load regulation, ripple rejection), Fixed volt regulators (IC78xx, 79xx), Linear voltage regulator IC 723(High voltage, low voltage regulator circuits), Introduction of SMPS, comparison of SMPS with linear power supply, Step -up and step down SMPS, Detail study of LM3524 Concept and applications of DC - DC converter.	

Chapter 3	Data Converters and Applications	10 lectures
	Digitization fundamentals, Performance specifications of D-A and A-D converters, D-A conversion techniques, **Digital to Analog Conversion Techniques:** Binary weighted type, R-2R ladder type **Analog to Digital converters:** Single slope, Dual slope, Flash, Counter type, Continuous type, Simultaneous type, Successive approximation type, SerialADC. Application of DAC's and ADC's Study of typical DAC and ADC ICs Problems on analysis and design.	
	Total Lectures	**45**

Text / Reference Books:

- **Electronic Devices and Circuit Theory,***by Robert Boylestead, Louis Nashelsky, PHI.*
- **Operational amplifier and linear integrated Circuits,***by Robert F Coughlin, Fredrick F. Driscoll, 6th Edition Prentice Hall*
- **Grob's Basic Electronics:***by Mitchel E. Schultz 11e McGraw Hill*
- **Design with Operational Amplifiers and Linear IC,***by Sergio Franco, 3rd Edn, TMH.*
- **Electronic Principles,***by Malvino and Bates, McGraw Hill.*
- **Operational amplifier,***by G.B. Clayton, Elsevier Sci. Tech.*
- **Microelectronic Circuits: Analysis and Design,***by Mohammad H. Rashid, PWS Publishing*
- **Microelectronic circuit:***by Sedra Smith, 6e oxford university press.*

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP202

Course Name: Digital System Design

Teaching Scheme: TH: 3Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Students need a thorough understanding of Boolean algebra, combinational and sequential digital circuits and number systems (binary, hexadecimal).

Course Objectives:

- To study sequential and combinational logic design techniques
- To learn PLD, CPLD, FPGA and their applications.
- The ability to code and simulate any digital function in Verilog HDL.
- Know the difference between synthesizable and non-synthesizable code.
- Understand library modeling, behavioral code and the differences between then.
- Understand the differences between simulator algorithms.
- Learn good coding techniques per current industrial practices.
- Understand logic verification using Verilog simulation.

Course Outcomes:

On completion of the course, student will be able to–

- design combinational circuits and sequential circuits using discrete components.
- understand PLDs and digital memories.
- An ability to design systems which include hardware and/or software components within realistic constraints such as cost, manufacturability, safety and environmental concerns.
- An ability to identify, formulate, and solve electrical and computer engineering problems.
- An ability to communicate effectively through written reports and oral presentations.
- An ability to use modern engineering techniques for analysis and design.
- An ability to analyze and design complex devices and/or systems containing hardware and/or software components.

Course Contents:

Chapter 1	Introduction to Verilog	13 lectures
	• Overview of Digital Design with Verilog HDL. • Basic Concepts: Synthesis, Data types, Constants, Parameters. • Continuous Assignment Statement, Procedural Assignment Statement, Logical Operators, Arithmetic Operators, Relational Operators, Equality Operators, Shift Operators, Vector Operators. • Conditional Expression, Always Statement, If Statement, Case Statement, Loop Statement, Modeling Flip-flops, Blocking and Non-blocking assignments. • Tasks and Functions, Gate level modeling	
Chapter 2	Digital Circuit and Verilog Modeling	20 lectures

	• **Combinational Logic Design**
	  • Arithmetic Circuits: Half-Adder, Full adder, Half-Subtractor, Full-Subtractor, BCD Adder, Arithmetic Logic Unit (ALU).
	  • Multipliers,Demultiplexers, Encoders, Decoders, Magnitude Comparator,
	• **Sequential Logic Design**
	  • Sequential Circuits, Types of Sequential Circuits: Synchronous Circuit, Asynchronous Circuit.	

	• Flip Flop Circuit: R-S, J-K, T andD Flip-Flop. • Level-Triggered and Edge-Triggered Flip-Flops, Flip-Flop Timing Parameters, Flip-Flop Applications. • Counters and Registers: Asynchronous Counter, Synchronous Counter, Cascading Counters, Designing Counters with Arbitrary Sequences. • Shift Register: Serial-In Serial-Out Shift Register, Serial-In Parallel-Out Shift Register, Parallel-In Serial-Out Shift Register, Parallel-In Parallel-Out Shift, Bidirectional Shift Register, Universal Shift Register. • **Verilog Modeling** • Modeling: Combinational Logic, Sequential Logics, Memory, Finite State Machine, Universal Shift register, ALU, Counter, Parameterized Adder, Comparator, Decoder, Multiplexer. • Model Optimizations: Resource Allocation, Common Subexpressions, Moving Code, Common Factoring, Commutativity and Associativity, Flip-Flop and Latch optimizations, Design Size.	
Chapter 3	PLDs, Memories and Verilog Verifications	12 lectures
	• **PLDs, Memories** • Need of PLD, architecture of simple PLD (SPLD)-PAL, PLA, • Complex Programmable Logic Device (CPLD) and • Field Programmable Logic Devices (FPGA) • CPLD/FPGA based system design applications: typical combinational and sequential system implementation, estimation of uses of blocks, links, LUTs, etc. • Memories: types, data storage principle, control inputs, and timings, applications, Random Access Memories (RAM), Static Ram (SRAM), standard architecture, address decoders, timings, Dynamic RAM (DRAM), different DRAM cells, refresh circuits, timings, role of memories in PLD. • **Verilog Verifications** • A Test Bench, Delay in Assignment Statements • Unconnected Ports, Missing Latches, More on Delays • Event List, Synthesis Directives, Variable Asynchronous Preset • Blocking and Non-blocking assignments: Combinational Logics, Sequential Logics.	
	Total Lectures	**45**

Text / Reference Books:

- **Digital Design; Principles Practices.***by Wakerly, PHI.*
- **Modern Digital Electronics,***by R.P Jain McGraw Hill.*
- **Digital Systems; Principles and Applications.***by Tocci, Pearson Education.*
- **Digital Logic and Computer Design.***by Morris Mano, PHI.*
- **Digital Electronics Principals, Devices and Applications**. *by Anil K. Maini.*
- **Verilog HDL Synthesis a Practical Primer,***by J. Bhasker, Star Galaxy Publishing.*
- **Verilog HDL; A Guide to Digital Design and Synthesis,***by Samir Palnitkar, Pearson Education, 2nd edition, 2003.*
- **Verilog HDL synthesis; A Practical Primer,***by J. Bhaskar, Star Galaxy Publishing, 1998.*
- **Digital System Design with VERILOG Design,***by Stephen Brown, ZvonkoVranesic, TMH, 2nd edition, 2007.*

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP203

Course Name: RF &Microwave Technology

Teaching Scheme: TH: 3Hours/Week **Credit: 03**

Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Physical quantities as vectors, concept of gradient, curl, and divergence, concept of rotation operator, covariant and contra-variant vectors, line, surface and volume – integrals, Gauss and Stokes theorem complex plane, polar form of complex number, complex functions, Cauchy-Riemann conditions, orthogonal functions and relation with Laplace equation.

Course Objectives:

- To introduce to students, the concepts of electromagnetic.
- To learn the theory of transmission lines and wave guides.
- To describe the basic principles of RF and microwave devices and circuits.
- To study various microwave components.
- To learn representation of RF and microwave devices by means of S parameters.
- To study various methods of generation of microwaves.

Course Outcomes:

On completion of the course, student will be able to–

- Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
- Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.
- Analyze the nature of electromagnetic wave propagation in guided medium which are used in microwave applications.
- Understand the distribution of electromagnetic fields within various transmission line geometries
- Use Smith chart to study transmission line applications for circuit elements and impedance matching.
- Study the performance of Wave Guides.
- Design the circuits of Microwave passive components.

Course Contents:

Chapter 1	Electromagnetic Waves:	15 lectures
	Vector Analysis: Scalars and Vectors, Vector Algebra, Rectangular (Cartesian) Coordinate System, Vector Components and Unit Vector, Vector Field, Products, Cylindrical Coordinates, Spherical Coordinates, Differential Length, Area and Volume, Line Surface and Volume integrals, Del Operator, Gradient of a Scalar, Divergence and Curl of a Vector, the Laplacian. Review of Maxwell's equations, boundary conditions, power flow and Poynting vector. Propagation of uniform plane waves in lossy media, conductors and dielectrics, skin depth, polarization, phase velocity and group velocity.	
Chapter 2	Transmission Lines, Waveguide and Microwave Components	15 lectures
	RF Transmission lines: Types of RF transmission lines, sinusoidal steady state excitation, transmission line equations, propagation constants, impedance matching, VSWR. Smith Chart, impedance matching – single stub and double stub matching. **Microwave waveguides:** Rectangular waveguides, TE and TM modes, power transmission and power losses, excitation of modes in rectangular waveguides. Circular waveguides, possible modes, power transmission and power losses, co-	

	axial waveguides. **Passive Microwave components**: Attenuators, Phase shifters, directional couplers, Hybrid Circuits, Faraday Rotation in Ferrites, Isolator, Circulator, Switch and Modulator, S parameters measurements.	
Chapter 3	Microwave Generators	15 lectures
	Microwave devices: Limitations of conventional tubes at microwave frequencies Velocity modulation, Basic Principles of two cavity Klystron and reflex Klystrons, Principles of operation of Magnetron and Travelling Wave Tubes. **Microwave Solid State Devices:** Principle, structure, construction and working of Gunn diodes, modes of operation, LSA diode, READ diode, IMPATT, TRAPATT and BARRIT diode, HEMT, tunnel diode.	
	Total Lectures	**45**

Text / Reference Books:

- **Microwave Devices and Circuits,***by Samuel Y. Liao, PHI, 3rd Edition, 2002.*
- **Principles of Electromagnetics,***by N. Sadiku, Oxford University Press.*
- **Electromagnetics with Applications,***by Kraus and Fleiseh, McGraw Hill, 5th Edn, 1999.*
- **Fundamentals of Applied Electromagnetics,***byFawwaz T. Ulaby, Eric Michielssen, Prentice Hall 6 Edition*
- **Microwave and Radar Engineering with Lab Manual,***byVinith Chauhan, University Science Press (An Imprint of Laxmi Publications Pvt. Ltd.)*
- **Microwave, Radar & RF Engineering with Laboratory Manual,***by Prakash Kumar Chaturvedi,Springer.*

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP204
Course Name: Instrumentation and Measurement Techniques

Teaching Scheme: TH: 3Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Basics of sensing elements, bridges and basic electronics, sensors and transducer

Course Objectives:

- To understand the configurations and functional descriptions of measuring instruments.
- To understand the basic performance characteristics of instruments.
- To understand the working principles of various types of sensors and transducers and their use in measuring systems.
- To study the techniques involved in various types of instruments.
- To understand the relevance of electronics with other disciplines.

Course Outcomes:

- On completion of the course, student will be able to design instrument for different parameters.
- Student will able to understand the principle of operation of generalized measurement system and different sources of errors in measurements.
- Understand the fundamental characteristics, terminologies, sensing and transduction principles of various types of transducer /sensors.
- Understand fundamentals of fluid flow and their applications to flow through pipes and hydraulic machines.
- Understand various techniques used for measuring parameters of temperature measurement in Industries.
- Understand the principles of industrial processes & process in pressure measurement
- Understand the different types of force & level measurements adopted in industrial
- Understand the fundamental characteristics, terminologies, sensing and transduction principles of various types of transducer /sensors.

Course Contents:

Chapter 1	Introduction to Measurement and Measurement Systems	09 lectures
	Definition and significance of measurement, classification of instruments and typesof measurement applications, elements of an instrument / measurement system,active and passive transducers, analog and digital modes of operation, null anddeflection methods, input-output configuration of instruments and measurementsystems, methods of correction of instruments and measurement systems. Generalized performance characteristics of instruments: static characteristics andstatic calibration, meaning of static calibration, true value, basic statistics, least–squares calibration curves, calibration accuracy versus installed accuracy,combination of components errors in overall system accuracy calculations, theoryvalidation by experimental testing.	
Chapter 2	Static Dynamic Characteristic of Measurement System	18 lectures
	Static sensitivity, linearity, threshold, noise floor, resolution, hysteresis and dead space, scale readability, span, generalized static stiffness and input impedance, loading effect Dynamic characteristics: generalized mathematical model of measurement system, operational transferfunction, sinusoidal transfer function, zero-order instrument, first order instrument, second order	

	instruments, step response, ramp response, frequency response of first –order instruments and second order instruments Errors in measurement: Types of Errors - gross,systematic, environmental errors, systemic errors, computational error, personal error etc.	
Chapter 3	Process Parameter Measurements	18 lectures
	Force, Torque and Shaft Power: standards and calibration, basic methods of, bonded strain gauge, differential transformer, piezoelectric, variable reluctance/ FM oscillator digital system, torque measurement on rotating shafts **Pressure and Sound Measurement:** standards and calibration, dead weight gauges andmanometers, low pressure measurement - Mcleod gauge, Knudsen gauge, viscosity, thermalconductivity, ionization, sound level meter, microphone, capacitor microphone **Flow measurement:** Pitot-static tube, Yaw tube, hot wire and hot film anemometers, LaserDoppler anemometer, Gross Volume Flow Rate- rotameter, turbine, ultrasonic flow meter,electromagnetic flow meters **Temperature and Heat Measurement Transducers:** standards and calibration, bimetallic thermos meters, liquid in glass thermometers, pressure thermometers, RTD, thermocouples,thermistors, semiconductor based temperature sensors, detailed discussion on basics ofthermocouples, laws of thermocouples, cold junction compensation; thermistor types,materials used, application circuits, LM35. **Radiation Fundamentals:** detectors, optical pyrometers, IR imaging systems, heat fluxsensing- slug type sensors, Gordon gauge.	
	Total Lectures	**45**

Text / Reference Books:

- **Measurement Systems, Applications and Design,***by Ernest O. Doeblin and Dhanesh N. Manik, 5th Edition, Tata McGraw Hill.*
- **A Course in Electrical and Electronic Measurements and Instrumentation,** *by A.K. Sawhney, Dhanpat Rai & Co.*
- **Electronic Instrumentation**,*byKalsi, TMH.*
- **Modern Electronic Instrumentation and Measurements Techniques,** *by Cooper and Helfrick, PHI.*

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP205
Course Name: Hardware Practical

Teaching Scheme: PH: 4 Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Course objectives:

- To study practical implementation of Amplifiers using Op-Amps.
- To study waveform generator circuits.
- To study filter circuits and convertors i.e. DAC and ADC.
- To study instrumentation based practical's.

Course outcomes:

Through this course, the students:

- Develop the ability to design and construct different amplifier circuits using operational amplifiers.
- Design and construct, waveform generator circuits, filters circuits using ICs and discrete components.
- Develop ability to design instrumentation based systems.

A. Practical based on Linear Integrated Circuits

1 Study of Data sheets of following IC's (Compulsory) µA 741, OP 07, LM324, LM 308, LM380, CA 3140, LM 311.

2 Study the characteristics of negative feedback amplifier

   a. A Unity gain amplifier

   b. A Non-inverting amplifier

   c. An Inverting Amplifier.

3 Plot frequency response of AC coupled amplifier using op amp 741 and study the effect of negative feedback on the bandwidth and gain of the amplifier.

4 To study Astable Multivibrator, Monostable MultivibratorUsing Op-Amp

5 Study of Comparator, ZCD, Schmitt Trigger using IC op 07 and Window detector using LM 311

6 Design of an Instrumentation amplifier using IC LM324

7 Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency.

8 Design of LPF, HPF, BPF and Band Reject Filters.

9 Voltage controlled current source / sink and current mirror.

10 To build and test current telemetry (4 to 20 mA).

11 Study of Quadrature / Bubba oscillator using op-amp

12 Study and implementation of ADC IC 0809 or Equivalent.

13 Study of R - 2R ladder network DAC and DAC IC1408 or Equivalent.

14 Study of LM3524 SMPS.

15 Study, design and perform PLL to determine F0, lock range (FL) and capture range (FC) using IC available IC(IC565/CD4046).

B. Practical based on Instrumentation

1 V to F and F to V using commercially available IC(IC331).

2 Study and calibration of Pt – 100 as a temperature sensor and its signal conditioning circuit.

3 Study of Strain gauge as load sensor and its signal conditioning circuit.

4 RPM measurement using various methods.

5 Design build and test IR transmitter and receiver (TSOP1738 or similar) for object detection.

6 Design build and test RMS to dc converter for voltage measurement of ac signal.

7 Study of linear displacement transducer and its signal conditioning circuit.

8 Study of optical sensors: LDR and photo diode and their signal conditioning circuit.

C. Practical based on Digital Electronics

1 Two-digit combinational lock.

2 Keyboard encoder with latches.

3 Traffic light controller.

4 Multiplexed display (Bank token / two-digit counter).

5 Bidirectional stepper motor control (Sequence Generator).

6 One digit BCD adder and 8-bit adder / subtractor.

7 Object counter (use of MMV, counter).

8 Binary-Gray and Gray-Binary code converter

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP206
Course Name: Software Practical

Teaching Scheme: PH: 4 Hours/Week **Credit: 03**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Course Objectives:

- To studypractical implementation of digital systems using Verilog.
- To study simulation for digital system using Verilog simulations.
- To port the Verilog design in FPGA and CPLDs.
- To study electromagnetic concepts using MATLAB.

Course Outcomes:

On completion of the course, student will be able to–

- An ability to design digital systems using Verilog in different Integrated Development Environment (IDEs).
- An ability to simulate digital system using simulation tools.
- An ability to implement digital system in FPGA and CPLDs.
- An ability to solved electromagnetic problems using MATLAB.

A. Practical on Verilog

1. Design 8 to 1-line MUX/ 1 to 8 DEMUX Use gate level, data flow, structural, behavioral style of modeling.
2. Design 2-4, 3-8 decoder (using Gate level, Structural, Behavioral modeling) and BCD to Seven Segment Decoder (using Behavioral modeling).
3. Arithmetic circuits: Half adder, Full adder (using Gate level, Data flow modeling) and Parallel adder using structural modeling.
4. Design
    a. 2-bit magnitude comparator using gate level modeling.
    b. 4-bit magnitude comparator using structural modeling.
5. Design of flip-flops using: RS, D and T using behavioral modeling and Design of Counter using T flip-flops (Use Structural modeling): Asynchronous counter and Asynchronous up/down counter.
6. Design the following
    a. Up-down bit binary counter (minimum 4-bit) using behavioral modeling.
    b. Shift register using D flip flops (Structural).
    c. Shift register using behavioral modeling.
7. Code converter – binary to gray, gray to binary using data flow modeling.
8. Encoder- 8 to 3 encoder, priority encoder using behavioral modeling.
9. Four bit ALU design (structural modelling).
10. Keyboard Scanning.
11. Designing of Traffic Light Controller.
12. LCD controller.
13. Practical based on state machine (Stepper sequence generator/Vending Machine/ Washing Machine).

B. Practical on Electromagnetics

1. To plot Equipotential contours and field lines for given charge distribution.
2. Use of Smith chart for transmission line pattern and verify using C.

3. Wave-propagation in conductors and dielectrics using HFSS*/CST**/MATLAB.
4. Current and charge flow of electromagnetic wave in a rectangular waveguide using HFSS/CST/MATLAB.
5. To show the modes of a rectangular waveguide using HFSS.

*HFSS – High Frequency Structure Simulator

**CST- Computer Simulation Tool

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5

First Year of M.Sc. Electronic Science (2019 Course)

Course Code: 19ScEleP207
Course Name: Virtual Instrumentation

Teaching Scheme: PH: 2Hours/Week **Credit: 02**
Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Knowledge of Analog Micro Electronics, Analog Integrated Circuits, Basic Electronics

Course Objectives:

- Acquire knowledge about transferring data into cloud using various Wired/Wireless communication technologies.

Course Outcomes:

- On completion of the course, student able to
- Apply structured programming concepts in developing VI programs and employ various debugging techniques.
- Apply the knowledge of LabVIEW programming for simulating and analyzing the data.
- Create applications that uses plug in DAQ boards and built in analysis functions to process the data.
- Build applications that use general purpose interface bus and Serial communication Interface.
- design and analyze various applications using control and simulation tool kit.
- Able to generate the report using built in LabVIEW functions.
- Engage in designing, implementing, analyzing and demonstrating an application using tools in available in LabVIEW through an open ended experiment

Course Contents:

Chapter 1	Introduction to Lab-VIEW	10 lectures
	Advantages of Lab-VIEW, software environment, LabVIEW based system designapproach:Front Panel, Block Diagram, Icon/Connector Pane,Programming tools: loops, tunnel, shift register, arrays, cluster, structures, creating a sub-VI's and sub-VI as icons. Signal Processing: waveform generation, waveform conditioning, dynamic data conversion toarrays, spectral. Data Acquisition : DAQ card configurations, block diagram, sampling and signal acquisition, measurement.	
Chapter 2	Hands on Practical's	20 lectures
	1. Development of basic algorithms in LabVIEW 2. Development of Sub VI a. Half adder design and designing full adder using Half Adder Sub-VI. b. Design 8:1 mux using 2:1 mux Sub-VI. 3. Generation of Fibonacci series using formula node and shift registers. 4. To build a VI to find whether a given number is prime number or not using flat sequencestructure/stacked sequence structure. 5. Development of algorithms using Arrays and clusters function pallets a. Create a 1-D numeric array and check whether the array elements are odd or even and in theoutput display 0 and 1respectively. b. To find the sum of positive and negative numbers in a given array. c. Build a VI that generates 1-D array and sort array in ascending and descending order.Also find themaximum and minimum number, size of array. d. Create a 2-D array and find the sum of rows and columns separately and display.	

	e. Build a VI that matches the input of containers consisting of two numeric input arrayclusters and display sine-wave if match is found else display a DC wave. 6. String and File Input and output operations using LabVIEW a. Build a VI which finds the number of occurrence of particular string in an array of strings. b. Build a VI to find whether the i/p string is a palindrome or not. c. Build a VI to split numbers and words available in a string and display the split numbers andwords in separate array. d. Create a table of Username and Password.Input a username and password, if match is found displayACCESS GIVEN else ACCESS DENIED. e. To open/create a file and perform read/write operations on a given file. 7. Amplitude Modulated wave generation and demodulate on. 8. Data Acquisition from various sensors using DAQ Cards- Finite and continuous bufferedacquisition mode. 9. Building a VI to simulate and study the performance of First order and second order systems.	
	Total Lectures	**30**

Text / Reference Books:

- **LABVIEW advanced programming techniques**,*by Rick Bitter, 2nd Edition, ERC Press*.
- **LabVIEW based Advanced Instrumentation Systems,***by S. Sumathi and P. Surekha, Springer Publication.*
- **Analog Electronics with LabVIEW**, *by Kenneth L. Ashley, Prentice Hall*
- **Virtual-Instrumentation-Using-LabVIEW,***byJovitha Jerome, PHI Learning Private Limited (2010)*
- **PC Interfacing for Data Acquisition and Process Control,***by Gupta, S. and Gupta, J.P., Instrument Society of America (1988).*