Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

Autonomous

Course Structure For M.Sc.- I : Electronic Science

2019 Pattern

Semester	Paper Code	Title of Paper	No. of Credits
I	ELE4101	Mathematical Methods in Electronics and Network Analysis	4
	ELE4102	Integrated Circuit Analysis	4
	ELE4103	Digital System Design	4
	ELE4104	Advanced 'C' Programming	3
	ELE4105	Practical Course –I	4
	ELE4106	Practical Course –II	4
	ELE4107	PLE	2

SYLLABUS (CBCS) FOR M.Sc. I. Electronic Science (w.e. from June, 2019)

Academic Year 2019-2020

Class : M. Sc. I (Semester- I)

Paper Code: ELE4101

Paper : I **Title of Paper : Mathematical Methods in Electronics and Network Analysis**

Credit : 4 No. of lectures: 60

Course Objectives:

1. To learn the methods of analysis for CT and DT signals and systems
2. To understand the various operations perform on signal.
3. Ability to bring out the important and modern methods for signal analysis.
4. To learn concept of mathematical modeling of simple electrical circuits
5. To get familiar with role of differential equations in applied electronics
6. To know about mathematical tools and techniques for network analysis
7. To study the network analysis and various theorem.

Course outcomes: After completion of the course, the student should be able to:

- **CO1.** To know the various types signal and its representation.
- **CO2.** Ability to classify the system.
- **CO3.** From this course, the students are expected to learn some mathematical techniques required to understand the Electronics phenomena at the postgraduate level.
- **CO4.** Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
- **CO5.** Students will demonstrate basic knowledge of Laplace Transform.
- **CO6.** Ability to find response of various filter.
- **CO7.** Analyze the circuit using Kirchhoff's law and Network simplification theorems

Unit-1: Electronic Signals and System (10L)

Signals: periodic, aperiodic, Continuous Time (CT) and Discrete Time (DT), Basic Operations on Signals, signal types, amplitude and phase spectrum, special electronic signals (impulse, unit step, sinusoidal, ramp, square wave, staircase), Amplitude and Phase Spectra, Classification of Systems, Representations of Systems.

Unit-2: Mathematical Tools for Circuit Analysis (20L)

Laplace Transform (LT): definition, 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, Network Transfer function, s-Plane Poles and Zeros. Z-Transform (ZT): definition, ZT of standard electronic signals, properties of Z transform, inverse ZT (partial fraction and residue method), linear difference equation and solutions using ZT. Concept of transfer function of CT and DT systems, 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, synthesis of transfer function using poles and zeros, stability criterion, Routh-Hurwitz criterion,

Unit-3: Differential Equations (15L)

Concept of modeling, types, mathematical modeling using differential equations, Differential Equation, Ordinary Differential Equations (ODE), DE and their occurrences in real life problems, linear differential equation with constant coefficients, partial DE, Introduction to coordinate systems (rectangular, cylindrical and spherical), method of separation of variables, General outline for solution of wave equation in cartesian and cylindrical coordinate system, Bessel DE and zeros of Bessel function and their significance, solution of Laplace equation in spherical coordinate system

Unit-4: Network Analysis (15L)

Two port network functions, Network Topology (nodes, tree, graph, branch, mesh, and loop), Mesh, loop and nodal analysis of circuits,T and π networks, state variable method with simple examples Network Theorems and Applications to DC and AC Circuits: Thevenin's, Norton's, superposition, maximum power transfer – theorems

Text / Reference Books:

1. Advanced Engineering Mathematics, E. Kreyzig, John Wiley andSons.
2. Signals and system by P Ramesh Babu and Anandanatarajan, SCItech
3. Network Analysis, G. K. Mittal, KhannaPublication.
4. CircuitsandNetworksAnalysisandSynthesis, A.Sudhakar,ShyamMohanand S. Pilli,TMH.
5. Digital Signal Processing, S. Salivahan, A. Vallavraj and C. Gnanpriya, McGraw Hill.
6. Network Analysis, M. E. Van Valkenberg,PHI.
7. Network and Systems, Roy Choudhary, WileyEastern.
8. Microwave Devices and Circuits, Samuel Y. Liao, 3rd Edition, PHI,2002.

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	2	-	2	-	-	-	-	-
CO2	2	3	-	3	-	-	-	-	-
CO3	1	1	2	-	1	2	-	2	1
CO4	1	2	2	-	2	1	-	2	1
CO5	2	2	-	1	-	-	-	1	2
CO6	1	2	2	2	2	3	-	-	2
CO7	2	1	-	-	-	2	-	-	-

Justification for the mapping

PO1: Disciplinary Knowledge

The course outcomes (COs) contribute to the development of students' disciplinary knowledge in electronics using mathematical tools. For example, CO1, CO2, CO3, and CO4 require students to master higher order linear differential equation and various transformation method for simplifying system response. CO5 and CO7 require students to apply these concepts to complex problems in electronic network simplification. CO6 require students to develop a deep understanding filter response.

PO2: Critical Thinking and Problem Solving

All of the COs contributes to the development of students' critical thinking and problem-solving skills. For example, CO1, CO2, CO3 and CO4 require students to think critically about how to apply different transformation method to solve problems. CO5 and CO7 require students to use their knowledge for Network simplification in complex electronic engineering problems. CO6 require students to think critically about simplifying the problem of output responses using filter.

PO3: Social competence

CO3, CO4 and CO6: Students will able to use various transformation methods and filter technics to crate solution or modeling of various applications for Social competence. Such as industrial, medical, automobile application etc.

.PO4: Research-related skills and Scientific temper

The entire COs contributes to the development of students' research-related skills and scientific temper. CO1, CO2, CO5 require students to learn how to use mathematical modeling, transformation method use for simplification and verify the result for complex circuit. CO6 requires student to develop their ability to design mathematical model using filter responses for improvement system performance.

PO5: Trans-disciplinary knowledge

All the COs contribute to the development of students' trans-disciplinary knowledge. CO3, CO4 and CO6 require students to learn how to apply mathematical models to problems in electronics and physics using mathematical modeling, transformation method and improvement system performance

PO6: Personal and professional competence

CO3, CO4, CO6, CO7 all contribute to the development of students' personal and professional competence. For example, all of the COs require students to develop their ability to work independently and as part of a team.

PO8: Environment and Sustainability

CO3, CO4, CO5: Student will think to develop simplified mathematical model for diver’s application.

PO9: Self-directed and Life-long learning

CO3, CO4, CO5 and CO6 all contribute to the development of students' ability to engage in self-directed and life-long learning. For example, the entire COs requires students to develop their ability to learn new concepts and apply them to new problems. They also require students to develop their ability to think critically about their own learning and to identify areas where they need to improve.

SYLLABUS (CBCS) FOR M.Sc. I. Electronic Science (w.e. from June, 2019)

Academic Year 2019-2020

Class : M. Sc. I (Semester- I)

Paper Code: ELE4102

Paper : I **Title of Paper : Integrated Circuit Analysis**
Credit : 4 No. of lectures : 60

Objectives:

1. To deliver the knowledge about physics of basic semiconductor devices and circuits.
2. To learn the characteristics and working of electronic devices
3. To study the various device models
4. To study the wideband and narrowband amplifiers using BJT
5. To develop skills in analysis and design of analog circuits
6. To study the designs of opamp applications.
7. To understand the various types of oscillators and tuned amplifiers.

Course Outcomes:

By the end of the course, students will be able to:

- CO1. Concept of basic semiconductor.
- CO2. Various characteristics of electronic devices and working of device model.
- CO3. Elucidate and design the active filters and oscillators.
- CO4. Understand and analyze the operational amplifier and its characteristics.
- CO5. Understand the basic material and properties of semiconductors.
- CO6. Explore constructional features and I-V characteristics of of basic semiconductor devices diode, Transistors.
- CO7. Design the circuits of amplifiers, filters and oscillators.

Unit-1: Basic Semiconductor Devices (15L)

Diode and applications- Practical diode characteristics (static and dynamic resistance), temperature effects, switching characteristics, diode breakdown, diode applications in wave shaping circuits.

BJT- construction and biasing, Operation, CC, CB and CB configurations

JFET- construction, types and its operation, parameters, characteristics, JFET amplifiers. MOSFET- types, biasing of MOSFET, applications, comparison between BJT, JFET, MOSFET.

Unit-2: Analysis of Amplifiers (15L)

BJT models and modeling parameters, equivalent circuits for CE, CB and CC configurations, single stage amplifier, class A and class B, class C, class AB amplifier, small signal analysis, distortion. Design of single stage RC-coupled amplifier with frequency response (f1 and f2), bode plots, Miller effect, frequency response of multistage amplifiers, different coupling schemes, gain of multistage amplifiers.

Unit-3: Tuned Amplifier and Oscillators (15L)

Tuned amplifier -design, multistage tuned amplifiers: synchronous and stagger tuning cascade configuration, large signal tuned amplifier
Oscillators- design and analysis of LC and RC oscillators, Hartley, Colpitt's, Miller oscillators, phase shift and Wien-bridge oscillators, crystal oscillators and applications

Unit-4: Operational Amplifiers and their Applications (15L)

Practical consideration in opamp based circuit design, opamp parameters such as dc and low frequency parameters and their significance in design of opamp, closed loop stability analysis and frequency compensation.
Inverting and non-inverting amplifiers with design aspects such as input and output impedance, common mode errors and limitations, bandwidth, etc.
Bridge and instrumentation amplifier
Practical design aspect of integrator and differentiators, such as offset error and stability, bandwidth considerations. Concept and applications of PLL.
Active Filters: transfer functions poles and zeros, Design of active filters - LPF, HPF, BPF and BRF (first and higher orders), Butterworth and Chebyshev filters.

Text / Reference Books:

1. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar, 3rd Edn, McGraw Hill.
2. Electronic Devices and Circuit Theory, Robert Boylestead, Louis Nashelsky, PHI.
3. Electronic Devices & Circuits: Milliman and Halki
4. Design with Operational Amplifiers and Linear IC, Sergio Franco, 3rd Edn, TMH.
5. Electronic Principles, Malvino and Bates, McGraw Hill.
6. Operational amplifier, G.B.Clayton, Elsevier Sci. Tech.
7. Microelectronic Circuits: Analysis and Design, Mohammad H. Rashid, PWS Publishing
8. Pulse, Digital Switching Circuits, Millman Taub, TMH.
9. Electronic devices, Allen Motershed, PHI.
10. Integrated electronics, Millman Halkies, McGraw Hill

Course Outcome	Program Outcome								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	2	-	2	-	-	3
CO2	3	3	1	2	-	2	-	-	3
CO3	3	3	1	2	-	2	-	-	3
CO4	3	3	1	2	-	2	-	-	3
CO5	3	3	1	2	-	2	-	-	3
CO6	3	3	1	2	-	2	-	-	3
CO7	3	3	1	2	-	2	-	-	3

Justification for the mapping

PO1: Disciplinary Knowledge

The course outcomes (COs) contribute to the development of students' disciplinary knowledge in electronics using various devices. For example, CO1, CO2, CO4, CO5 and CO6 require students to know the semiconductor behavior of different components, it characteristics and operations. CO3 and CO7 require students to apply these concepts to electronic circuit design for amplifiers, filters and oscillators.

PO2: Critical Thinking and Problem Solving

All of the COs contributes to the development of students' critical thinking and problem-solving skills. For example, CO1, CO2, CO4, CO5 and CO6 require students to think critically about semiconductor behavior of different components, effect of temperature. CO5 and CO7 require students to use their knowledge for electronic engineering problems solving.

PO3: Social competence

CO7: Students will able to design electronic circuits using various ICs for Social competence. Such as industrial, medical, automobile application etc.

.**PO4: Research-related skills and Scientific temper**

The entire COs contributes to the development of students' research-related skills and scientific temper. CO1, CO2, CO4 CO5 and CO6 require students to learn how to use basic semiconductor devices, its operations characteristics for improvement of system performance, reducing error, stable for research related applications.

PO6: Personal and professional competence

CO3, CO4 and CO7 all contribute to the development of students' personal and professional competence. For example, all of the COs require students to develop their ability to work independently and as part of a team in electronic system design.

PO9: Self-directed and Life-long learning

CO2, CO4, CO6 and CO7all contribute to the development of students' ability to engage in self-directed and life-long learning. For example, the entire COs requires students to develop their ability to learn new concepts and apply them to electronic system design for new problems. They also require students to develop their ability to think critically about their own learning and to identify areas where they need to improve.

SYLLABUS (CBCS) FOR M.Sc. I. Electronic Science (w.e. from June, 2019)

Academic Year 2019-2020

Class : M. Sc. I (Semester- I)

Paper Code: ELE4103

Paper : I **Title of Paper : Digital System Design**
Credit : 4 No. of lectures: 60

Course Objective:-

1. To introduce VERILOG
2. To understand combinational Circuit
3. To understand combinational Circuit
4. To learn various digital circuits using VERILOG
5. To learn FSM.
6. To understand memory Concept
7. To Understand PLD Concept.

Course Outcome:-

By the end of the course, students will be able to:

CO1. To know the basic language features of Verilog HDL and the role of HDL in digital logic design

CO2. To know the various modeling of combinational and simple sequential circuits.

CO3. To know the architectural features of programmable logic devices

CO4. Construct the combinational circuits, using discrete gates and programmable logic devices.

CO5. Describe Verilog model for sequential circuits and test pattern generation.

CO6. Design a semiconductor memory for specific chip design.

CO7. Design FSM for industrial Application.

Unit-1: HDL for Digital System Design (10L)

VERILOG: design flow, EDA tools, data types, modules and ports, operators, gatelevel modeling, data flow modeling , behavioral modeling, tasks and functions, timing and delays, test bench, types of test bench, comparison between VERILOG and VHDL language

Unit-2: Combinational Logic (15L)

Introduction to combinational circuits, realization of basic combinational functions - magnitude comparator, code converters, multiplexers, demultiplexers, multiplexed display, encoder and decoders, priority encoders, parity generator/checker, arithmetic circuits (adder, subtractor, binary multiplier), parallel adder, look ahead carry generator VERILOG models and simulation of above combinational circuits

Unit-3: Sequential Logic Design and Circuits (20L)

Introduction to sequential circuits Flip Flops: types, state table, transition table, excitation tables, timing waveforms, clock generators Counters: synchronous, asynchronous, design of counters, up/down counter Shift Registers: ring counter, Johnson counter Finite State Machine (FSM) Design: Mealy and Moore state machines VERILOG Models and Simulation of above

Sequential Circuits and FSMs: stepper motor controller, traffic light control, washing machine control, parking controller, coffee vending machine, LCD controller

Unit-4: PLDs and Memories (15L)

VLSI devices: Need of PLD, antifuse, 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, 6 transistor cell diagram, sense amplifier, address decoders, timings, Dynamic RAM (DRAM), different DRAM cells, refresh circuits, timings, role of memories in PLD

Text / Reference Books:

1. Verilog HDL; A Guide to Digital Design and Synthesis, Samir Palnitkar, Pearson Education, 2nd edition,2003.
2. Verilog HDL synthesis; A Practical Primer, J. Bhaskar, Star Galaxy Publishing, 1998.
3. Digital System Design with VERILOG Design, Stephen Brown, Zvonko Vranesic, TMH, 2 ndEdn,2007.
4. Digital design; Principles Practices, Wakerly, PHI.
5. Modern Digital Electronics, R.P Jain, McGrawHill.
6. Digital systems; Principles and Applications, Tocci, Pearson Education.
7. Digital Logic and Computer Design, Morris Mano, PHI.

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	2	1	2	1	1
CO2	2	1	1	1	3	-	1	-	-
CO3	-	3	-	2	-	1	-	-	-
CO4	-	-	-	2	-	-	2	-	-
CO5	1	1	-	3	-	-	-	-	-
CO6	-	-	-	1	2	-	-	-	-
CO7	2	1	-	-	-	-	-	-	-

Justification for the mapping

PO1: Disciplinary Knowledge

CO1: Understanding the basic language features of Verilog HDL contributes to the disciplinary knowledge in digital logic design.

CO2: Understanding different modeling techniques for combinational and sequential circuits enhances disciplinary knowledge in digital circuit design.

CO5: Describing Verilog models for sequential circuits contributes to the disciplinary knowledge in digital circuit design.

CO7: Designing Finite State Machines (FSMs) for industrial applications enhances disciplinary knowledge in control systems and automation.

PO2: Critical Thinking and Problem Solving

CO1: Learning Verilog HDL requires logical thinking and problem-solving skills to effectively design digital circuits.

CO2: Designing various circuit models requires critical thinking and problem-solving skills.

CO3: Understanding the architecture of programmable logic devices contributes to the critical thinking and problem-solving skills.

CO5: Describing Verilog models for sequential circuits contributes to the critical thinking and problem-solving skills.

CO7: Designing Finite State Machines (FSMs) for industrial applications enhances to the critical thinking and problem-solving skills.

PO3:Social competence

CO1: Understanding the basic language features of Verilog HDL contributes to the Social competence.

CO2: Understanding different modeling techniques for combinational and sequential circuits enhances Social competence in digital circuit design.

PO4: Research-related Skills and Scientific Temper

(CO1 to CO6): All above co provide Research-related Skills and Scientific Temper

PO5: Trans-disciplinary knowledge

CO1: Understanding the basic language features of Verilog HDL contributes to the Trans-disciplinary knowledge

CO2: Designing various circuit models requires Trans-disciplinary knowledge.

CO6.Design a semiconductor memory for specific chip design is Trans-disciplinary knowledge

PO6: Personal and Professional Competence

CO1: Learning Verilog HDL requires Personal and Professional Competence to effectively design digital circuits.

CO3: Understanding the architecture of programmable logic devices contributes to the Personal and Professional Competence.

PO7:Effective Citizenship and Ethics

CO1: Learning Verilog HDL Effective Citizenship and Ethics skills to effectively design digital circuit

CO2: Understanding different modeling techniques for combinational and sequential circuits enhances Effective Citizenship and Ethics in digital circuit design.

CO4: Effective Citizenship and Ethics are crucial when selecting the appropriate components and configuring programmable logic devices.

PO8: Environment and Sustainability:

CO1: Learning Verilog HDL requires Sustainability to effectively design digital circuits.

PO9: Self-directed and Life-long learning

CO1: Designing Finite State Machines (FSMs) for industrial applications enhances Self-directed and Life-long learning in control systems and automation.

SYLLABUS (CBCS) FOR M.Sc. I. Electronic Science (w.e. from June, 2019)

Academic Year 2019-2020

Class : M. Sc. I (Semester- I)

Paper Code: ELE4104

Paper : I **Title of Paper : Advanced 'C' Programming**

Credit : 3 No. of lectures: 60

Course Objectives:

1. To understand basic concepts of C programming language.
2. To know the concepts of control statements, storage classes.
3. To understand structure and union in C.
4. To develop the C Program for structure, file, user defined function and union.
5. To learn various advanced features of C programming.
6. To get the knowledge of C graphics.
7. To learn concepts of OOP in C++.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Know basic concept of C.
CO2: Develop a C program.
CO3: Understand basics and program of Graphics.
CO4: Read, understand and trace the execution of programs written in C language.
CO5: Write the C code for a given algorithm.
CO6: Implement Programs with pointers and arrays, perform pointer arithmetic.
CO7: Design the programs that perform operations using derived data types.
CO8: Understand OOP and C++.

Unit-1: Basics of C (15L)

C fundamentals: Introduction of high-level programming language, operators and it's precedence, various data types in C, storage classes in C.
Control statements: Decision–making and forming loop in programs.
Arrays & pointers: handling character, arrays in C, pointers in C, advanced pointers, structure and union.
Functions: user defined function, pointer to functions.

Unit-2: Advanced Features and Interfacing (15L)

Miscellaneous and advanced features: command line argument, dynamic memory Allocation, Data files in C, file handling in C.
Graphics in C: graphics-video modes, video adapters, drawing various objects on Screen.
Interfacing: interfacing to external hardware, via serial/parallel port using C, applying C to electronic circuit problems.

Unit-3: Introduction to C++ (15L)

Introduction to object –oriented programming and C++, characteristics, objects,Classes, inheritance, polymorphism, overloading.

Text / Reference Books:

1. Computer programming in C, V. Rajaraman, Pearson Education, 2nd edition, 2003.
2. The C programming language, Dennis Ritchie, Pearson Education, 2nd edition, 2003.
3. Graphics programming in C, Roger T. Stevens, BPB Publications.
4. Object oriented programming in C++, Robert Lafore, Galgotia Publications.
5. Programming in C, Stephen G. Kochan. CBS

Course Outcome	Program Outcome								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	2	1	2	-	-	3
CO2	3	3	1	2	1	2	-	-	3
CO3	3	3	1	2	1	2	-	-	3
CO4	3	3	1	2	1	2	-	-	3
CO5	3	3	1	2	1	2	-	-	3
CO6	3	3	1	2	1	2	-	-	3
CO7	3	3	1	2	1	2	-	-	3

Justification for the mapping

PO1: Disciplinary Knowledge:

CO1.: Acquiring a basic understanding of C concepts establishes foundational disciplinary knowledge in computer programming, forming the basis for advanced learning and expertise in the field.

CO2: Developing C programs contributes to disciplinary knowledge by applying theoretical concepts in practical scenarios, fostering a deeper understanding of programming principles.

CO3: Understanding the basics and programming of graphics enhances disciplinary knowledge by integrating concepts from computer science into the realm of visual communication and multimedia.

CO4: Reading, understanding, and tracing the execution of C programs contribute to disciplinary knowledge by honing analytical skills and deepening comprehension of programming constructs.

CO5: Writing C code for algorithms reinforces disciplinary knowledge by translating abstract algorithmic solutions into executable code, showcasing practical application of algorithmic principles.

CO6: Implementing programs with pointers and arrays, and performing pointer arithmetic, enriches disciplinary knowledge by delving into the intricacies of memory management and manipulation in C programming.

CO7: Designing programs that operate on derived data types advances disciplinary knowledge by applying principles of data structures and enhancing proficiency in C programming.

CO8: Understanding Object-Oriented Programming (OOP) principles in C++ expands disciplinary knowledge by integrating concepts from C programming into a broader understanding of software development methodologies.

PO2: Critical Thinking and Problem solving:

CO1: Acquiring a basic understanding of C concepts fosters critical thinking skills by laying the foundation for logical problem-solving and analytical reasoning in programming challenges.

CO2:Developing C programs cultivates critical thinking and problem-solving skills by requiring students to apply logical reasoning and algorithmic approaches to address various computational tasks.

CO3: Involves critical thinking, as students must creatively solve problems related to visual communication and multimedia within the context of programming.

CO4: Develops critical thinking skills, essential for effective problem-solving, debugging, and program comprehension.

CO5: Writing C code for algorithms necessitates critical thinking, as students must logically translate abstract algorithmic solutions into executable code, demonstrating problem-solving abilities.

CO6: Implementing programs with pointers and arrays, along with performing pointer arithmetic, requires critical thinking skills for efficient memory manipulation and problem-solving in C programming.

CO7: Engages critical thinking in problem-solving, showcasing the application of data structures and logical design principles in C programming.

CO8: Involves critical thinking, as students must grasp abstract concepts and apply them to problem-solving scenarios in software development.

PO3: Social competence:

CO1: Facilitating effective communication and collaboration in programming teams, fostering a shared understanding of fundamental concepts.

CO2: Enhances social competence as students engage in collaborative programming projects, fostering effective teamwork, communication, and shared problem-solving skills within a social context.

CO3: Promotes social competence by enabling students to collaborate on multimedia projects, emphasizing effective communication and teamwork in the development of visual content.

CO4: Contribute to social competence by emphasizing effective communication and collaboration in programming teams, ensuring a shared understanding of code execution.

CO5: Enhances social competence as students collaborate on algorithmic solutions, promoting effective communication and teamwork in translating abstract ideas into executable code.

CO6: Encouraging collaboration on complex programming tasks, emphasizing teamwork in solving challenges related to memory manipulation.

CO7: Develops social competence through collaborative design projects, promoting effective communication and teamwork in the development of complex software solutions.

CO8: As students collaborate on software development projects, emphasizing effective communication and teamwork in the application of OOP concepts.

PO4: Research-related skills and Scientific temper :

CO1: Fosters research-related skills and a scientific temper by encouraging systematic exploration and inquiry into programming principles, laying the groundwork for future investigations.

CO2: Cultivates research-related skills and a scientific temper as students engage in practical experimentation, problem-solving, and the application of scientific methodologies to program development.

CO3: Contributes to research-related skills by encouraging exploration and experimentation in multimedia programming, fostering a scientific approach to creative expression.
CO4: Develops research-related skills and a scientific temper by promoting analytical inquiry into program logic and systematic problem-solving.
CO5: Enhances research-related skills and a scientific temper by requiring students to apply logical reasoning and systematic approaches to algorithmic problem-solving within a programming context.
CO6: Fosters research-related skills and a scientific temper through the systematic exploration of memory manipulation and program efficiency.
CO7: Designing programs that operate on derived data types develops research-related skills and a scientific temper by encouraging systematic exploration of data structures and their applications in program design.
CO8: Contributes to research-related skills and a scientific temper by encouraging systematic exploration of software development methodologies and object-oriented design principles.

PO5: Trans-disciplinary knowledge:
CO1: Contributes to trans-disciplinary knowledge by establishing a foundation in computer programming that can be applied across various domains and disciplines.
CO2: Enhances trans-disciplinary knowledge by providing practical programming skills that can be applied in diverse fields, extending the applicability of programming principles beyond computer science.
CO3: Extends trans-disciplinary knowledge by integrating principles from computer science into the broader context of visual communication and multimedia across various disciplines.
CO4: Contribute to trans-disciplinary knowledge by honing analytical skills that are valuable in various fields where logical problem-solving is essential.
CO5: Promotes trans-disciplinary knowledge by developing algorithmic problem-solving skills that have applications beyond computer science in diverse problem domains.
CO6: Enhances trans-disciplinary knowledge by emphasizing memory manipulation skills applicable in various programming scenarios.
CO7: Advances trans-disciplinary knowledge by showcasing the application of data structures, which have relevance in multiple fields requiring structured information representation.
CO8: Extends trans-disciplinary knowledge by integrating C programming concepts into broader software development methodologies applicable across different domains.

PO6: Personal and professional competence:
CO1: Contributes to personal and professional competence by providing a foundational skill set essential for effective communication and collaboration in a professional programming environment.
CO2: Enhances personal and professional competence by honing programming skills, fostering a sense of accomplishment, and preparing students for real-world software development scenarios.
CO3: Understanding graphics basics and programming in C contributes to personal and professional competence by adding a valuable skill set in multimedia programming, enhancing versatility in professional roles.
CO4: Reading, understanding, and tracing the execution of C programs develop personal and professional competence by cultivating analytical skills and attention to detail, essential in a professional programming environment.
CO5: Instilling confidence in algorithmic problem-solving and preparing students for effective contribution in professional software development.

CO6: Contributes to personal and professional competence by developing advanced programming skills crucial for efficient and optimized code development.
CO7: Advances personal and professional competence by emphasizing software design skills, a key aspect of professional programming.
CO8: Understanding Object-Oriented Programming (OOP) principles in C++ enhances personal and professional competence by introducing students to modern software development methodologies, preparing them for professional roles requiring OOP expertise.

PO9: Self-directed and Life-long learning:
CO1:Fosters self-directed and life-long learning by laying the foundation for continuous exploration and improvement of programming skills throughout one's career.
CO2: Encouraging students to independently explore advanced programming concepts and continuously refine their programming abilities.
CO3: Inspiring students to explore and master multimedia programming, fostering continuous skill development in this specialized area.
CO4: Promoting independent exploration of program logic and the continuous refinement of analytical skills.
CO5: Enhances self-directed and life-long learning by instilling a habit of independent problem-solving and encouraging a proactive approach to continuous skill enhancement in algorithmic development.
CO6: Fosters self-directed and life-long learning by encouraging students to explore advanced memory manipulation techniques independently, ensuring ongoing skill development.
CO7: Inspiring students to independently explore and apply advanced software design principles throughout their careers.
CO8: Contributes to self-directed and life-long learning by preparing students for continuous exploration of modern software development methodologies and practices throughout their professional journey.

SYLLABUS (CBCS) FOR M.Sc. I. Electronic Science (w.e. from June, 2019)

Academic Year 2019-2020

Class : M. Sc. I (Semester- I)

Paper Code: ELE4105

Paper : II Title of Paper : Practical Course –I
Credit 4

Group A: Analog Circuit Design -7

Group B: Digital Electronics (hardware) - 3

Group C: Activity - 2

Note that for Group C: Activity, please refer Section 5) Examination of this document.

Course Objectives:

1. To understand the basics operation of electronic devices.
2. To learn connection using breadboard.
3. To understand the working of analog circuit.
4. To learn design process of oscillator circuit.
5. To understand the working of digital ICs.
6. To learn filter response.
7. To study the power supply.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Learn the advanced analysis facilities available in DSO, function generators.
CO2. Experiment analog electronic circuits using discrete components and ICs.
CO3. Evaluate different electronic circuits and review the analog and digital circuits.
CO4. Develop ability to design, build and test analog/digital application circuits.
CO5. To know operation of different instruments used in the laboratory.
CO6. To connect circuit and do required performance and analysis
CO7. Capability to develop experimental skills, analyzing the results and interpret data.
CO8. Develop hobby projects.

[A] Practical based on Circuit Design

1. Bootstrap ramp generator for delay triggering
2. Blocking oscillator
3. Tuned amplifier small signal / large signal for IF
4. Transistor based microphone amplifier
5. Voltage controlled current source / sink and current mirror and doubler
6. Comparator and Schmitt trigger with single supply operation
7. Second order Butterworth filters (BP and BR)

8. Waveform generation: quadrature oscillator, Bubba oscillator
9. V to f and f to V using commercially available IC
10. Instrumentation amplifier for a given gain
11. Low current negative power supply using IC555 / dual power supply using single battery
12. PLL characteristics and demonstrate any one application(IC565/CD4046)
13. Clipper and Clampper using Opamp.

[B] Practical based on Digital Design
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

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	2	-	2	-	-	-	-	-
CO2	2	3	-	3	3	-	-	-	-
CO3	1	2	-	1	1	2	-	2	1
CO4	1	2	-	1	2	1	2	2	1
CO5	2	2	1	1	2	2	-	1	2
CO6	1	2	2	2	2	3	-	-	2
CO7	2	1	2	2	3	2	-	-	3

Justification for the mapping

PO1: Disciplinary Knowledge

The course outcomes (COs) contribute to the development of students' disciplinary knowledge in electronics. For example, CO1, CO2, CO3 require students to know the function instruments, components and circuits. CO4, CO5 and CO6 require developing analog or digital circuit. CO7 require students to apply these concepts to develop design hobby project.

PO2: Critical Thinking and Problem Solving

The entire COs contributes to the development of students' critical thinking and problem-solving skills. For example, CO1, CO2 and CO5 require students to think critically about operation of different instruments and ICs. CO3, CO4 and CO6 require students to think critically about how to design analog or digital circuit for dedicated application and its response. CO7 require students to think critically about the new circuit design.

PO3: Social competence

CO5, CO6 and CO7: contributes to the development of students' for problem-solving skills. They think the solution and design circuit for social need.

.PO4: Research-related skills and Scientific temper

The entire COs contributes to the development of students' research-related skills and scientific temper. CO1, CO2, CO3, CO4, CO5 CO6 and CO7 require for students to think to design circuit for problem solving and formulate the hypothesis.

PO5: Trans-disciplinary knowledge

CO2, CO3, CO4, CO5, CO6 and CO7 contribute to the development of students' trans-disciplinary knowledge. Student will able to design system for practical problems solve interdisciplinary field.

PO6: Personal and professional competence

CO3, CO4, CO5, CO6 and CO7 all contribute to the development of students' personal and professional competence. Students to develop their ability to work independently or as a team to solve real-world problems. Students develop their skills for starting own start-up in electronics design. Students use their knowledge to develop suitable solution for interdisciplinary field such as physics, chemistry, agriculture, industrial, botany etc.

PO8: Environment and Sustainability

CO3, CO4 and CO5 required to student for thinking development of analog or digital circuit for simplified practical problems for energy conservation, soil, water or environment parameter monitoring and easy handling laboratory instruments.

PO9: Self-directed and Life-long learning

CO3, CO4, CO5, CO6, and CO7 all contribute to the development of students' ability to engage in self-directed and life-long learning. For example, the entire COs requires students to develop their ability to learn new concepts of designing and apply them to new problems. It is lifelong learning due to hands on practical.

SYLLABUS (CBCS) FOR M.Sc. I. Electronic Science (w.e. from June, 2019)

Academic Year 2019-2020

Class : M. Sc. I (Semester- I)

Paper Code: ELE4106

Paper : II Title of Paper : Practical Course –II
Credit 4

Objectives:

1. To understand the basics of verilog programming.
2. To learn CPLD/FPGA boards.
3. To understand the digital system design.
4. To learn digital circuit design in verilog.
5. To study MATLAB command for communication and simulation.
6. To understand the use of MATLAB for filter, modulation, antenna and transfer function design.
7. To learn C program for differential equation. .

Course Outcomes:
By the end of the course, students will be able to:

CO1: Verilog programming for CPLD/FPGA boards.
CO2: Implement digital systems on CPLD/FPGA boards.
CO3: Analyze complicated circuits using different network theorems and acquire skills of using MATLAB/ C software for electrical circuit studies.
CO4: Create, design and develop problem solving ability.
CO5: Understand state of the art, technology and development.
CO6: Develop soft skills needed.
CO7: Get knowledge of self-employability.

Group A: VERILOG programming, CPLD/FPGA 06
Group B: C/MATLAB programming 04
GroupC: Activity 02
Note that for Group C: Activity, please refer Section 5) Examination of this document.

[A] Practical Based on VERILOG Programming and Implementation on CPLD or FPGA

1. 4 bit logic gates
2. Combinational Logic
    a. Parity Generator and checker
    b. Hamming Code Generator
    c. Manchester code Generator
3. Sequential Logic
    a. Up-down bit binary counter (minimum4-bit)

b. Universal shift register

4. Four bit ALU design (structural modelling)
5. Designing of Traffic light Controller
6. Implementation of 8 bit multiplexer
7. LCD controller
8. Code Converter (BCD to seven Segment)
9. Practical based on state machine (Stepper sequence generator/Vending
10. Machine/ Washing Machine)
11. 10.Adder and subtractor

[B] Practical based on C / MATLAB

1. Phase and frequency response from transfer function of a CT system: Low Pass
2. and High Pass
3. Phase and frequency response from transfer function of a DT system: Low Pass
4. and High Pass
5. Simulation of transfer function using poles and zeros
6. Synthesis of periodic waveform from Fourier coefficients
7. Solution of differential equation with given boundary conditions
8. Analysis of a given dc electrical circuit
9. Effect of locations of poles and zeros on the transfer function and corresponding
10. frequency response
11. Representation of standard test signals
12. AM/FM modulation and demodulation
13. 10.Use of MATLAB for directivity pattern for simple antennas

Course Outcome	Program Outcome								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	3	1	2	-	1	3
CO2	3	3	1	3	2	2	-	1	3
CO3	3	3	1	3	1	2	-	1	3
CO4	3	3	1	3	2	1	-	1	3
CO5	3	3	1	3	1	2	-	1	3
CO6	3	3	1	3	1	1	-	1	3
CO7	2	2	1	3	2	2	-	1	3

Justification for the mapping

PO1: Disciplinary Knowledge

CO1, CO2: Ensures a strong foundation in disciplinary knowledge, aligning with the practical application of digital design principles.
CO3: Enhances disciplinary knowledge by providing hands-on experience in electrical circuit studies and analysis.
CO4: Creating, designing, and developing problem-solving abilities in the context of digital systems and circuit analysis contribute to a comprehensive understanding of the discipline, fostering a problem-solving mindset.
CO5, CO6, CO7: Understanding the state of the art in digital systems and electrical circuits, coupled with the development of soft skills, contributes to disciplinary knowledge by preparing individuals for the technological advancements and employability within the field.

PO2: Critical Thinking and Problem solving:

CO1, CO2: Fostering the ability to design and troubleshoot complex digital circuits.
CO3: Analyzing intricate circuits with various network theorems and utilizing software tools like MATLAB, C, and PSPICE enhances critical thinking and problem-solving abilities in electrical circuit studies.
CO4: Creating, designing, and developing solutions for complex problems in digital systems contribute to honing critical thinking and problem-solving skills, aligning with the ability to address challenges in the field.
CO5, CO6, CO7: Understanding the state of the art in technology and development requires critical evaluation, and the development of soft skills for effective communication and self-employability further emphasizes critical thinking in diverse contexts.

PO3: Social competence:

CO1, CO2: Collaborative work on Verilog programming and implementing digital systems fosters social competence by encouraging teamwork, communication, and shared problem-solving in a technological context.
CO3: Collaborative analysis of intricate circuits using tools like MATLAB, C, and PSPICE promotes social competence through teamwork, knowledge sharing, and mutual support in understanding electrical circuit studies.
CO4, CO5, CO6, CO7: preparing individuals for effective interaction, communication, and collaboration in diverse professional settings.

PO4: Research-related skills and Scientific temper

CO1, CO2: Enhances research-related skills by enabling exploration and experimentation with advanced technologies in the field of CPLD/FPGA boards.
CO3: Fosters research-related skills by encouraging a systematic and scientific approach to electrical circuit studies.
CO4, CO5, CO6, CO7: Creating, designing, and problem-solving within the context of technology and development contribute to research-related skills, promoting a scientific temper and innovative thinking.

PO5: Trans-disciplinary knowledge

CO1, CO2: Involve trans-disciplinary knowledge by integrating hardware description languages and digital design principles from various fields.

CO3: Analyzing complex circuits with tools like MATLAB, C, and PSPICE requires a trans-disciplinary approach, combining electrical engineering principles with computational and software skills.
CO4, CO5, CO6, CO7: Problem-solving, understanding the state of the art, and developing soft skills in the context of electrical systems contribute to a trans-disciplinary perspective, considering both technical and non-technical aspects.

PO6: Personal and professional competence:

CO1,CO2: Fostering technical proficiency and hands-on skills in the field of CPLD/FPGA-based digital design.
CO3: Honing analytical and software skills crucial for electrical circuit studies.
CO4, CO5,CO6,CO7: Creating, designing, and problem-solving in electrical systems, coupled with understanding technology trends and developing soft skills, contribute to personal and professional competence, fostering self-employability.

PO8: Environment and Sustainability

CO1: Promoting efficient design practices, reducing resource consumption, and aligning with green technologies in CPLD/FPGA-based systems.
CO3: Aligns with environmentally sustainable practices in electrical circuit studies, fostering awareness and responsible use of resources.
CO4: Reflects an understanding of environmental sustainability, ensuring that developments align with eco-friendly practices.

PO9: Self-directed and Life-long learning

CO1: Fosters self-directed and life-long learning by equipping individuals with skills to adapt and grow in a dynamic technological landscape.
CO3: Promotes self-directed learning, empowering individuals to engage in continuous learning throughout their careers.
CO4: Developing problem-solving ability, understanding the state of the art, and acquiring self-employability skills all contribute to a mindset of self-directed and life-long learning, ensuring adaptability in a changing professional landscape.