# FIRST YEAR M.Sc.
# ELECTRONIC SCIENCE

## SEMESTER - I

## Academic Year 2022-2023

2022 Pattern

**M.Sc. Electronic Science - Course structure & Credits Distribution**

| Semester | Course Code | Course Title | No. of credits |
|---|---|---|---|
| **Sem-I** | PSEL111 | **Mathematical Methods in Electronics and Network Analysis** | 04 |
| | PSEL112 | **Integrated Circuit Analysis** | 04 |
| | PSEL113 | **Digital System Design using Verilog** | 04 |
| | PSEL114 | **Advanced ‘C’ & JAVA Programming.** | 04 |
| | PSEL115 | **Electronics Science Practical Course I** | 04 |
| | PSEL116 | **Electronics Science Practical Course II** | 04 |
| | | | |

**Faculty of Science**
**Post Graduate Extra Credits**

| Semester | Course Code | Title of the Course | No. of Credits |
|---|---|---|---|
| I | | Human Rights - I | 2 |
| | | Introduction to Cyber Security - I | 2 |
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## PSEL111: Mathematical Methods in Electronics and Network Analysis [Credit-4]

**Objectives:**

1. To learn the methods of analysis for CT signals and systems
2. To learn the methods of analysis for DT signals and systems
3. To learn concept of mathematical modeling of simple electrical circuits
4. To get familiar with role of differential equations in applied electronics
5. To know about mathematical tools and techniques for network analysis
6. To learn MATLAB environment.
7. To increase the thinking ability in simplifying and reducing network and analysis.

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

CO1. From this course, the students are expected to learn some mathematical techniquesrequired to understand the Electronics phenomena at the postgraduate level.
CO2. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
CO3. Students will demonstrate basic knowledge of Laplace Transform.
CO4. Able to use various transformation method.
CO5. Analyze the circuit using Kirchhoff's law and Network simplification theorems
CO6. System analyze using MATLB
CO7. Student will able to write MATALB program using various commands.

**Unit-1: Mathematical Modeling, Electronic Signals & System (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

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), 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.
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: 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 $\pi$ 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.

**Unit 4:Signal and System Analysis using MATLAB (10L)**

**MATLAB environment**: Basic Structure of Matlab, File types, Matlab commands and operators, tool boxes, Arithmetic and Logical operations. Creating simple plots, MATLAB scripts and functions (m-files), Control structures (if, if-else, else-if, switch, for, while etc).

**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.
9. Basics of MATLAB and Beyond by Andrew Knight, CRC


| Course Outcome | Program Outcomes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
| CO1 | 1 | 2 | 1 | 2 | - | - | - | - | - |
| CO2 | 2 | 3 | 1 | 3 | 3 | - | - | - | 2 |
| CO3 | 1 | 2 | - | 2 | 1 | - | - | - | 1 |
| CO4 | 1 | 2 | - | 1 | 2 | 1 | - | - | 2 |
| CO5 | 2 | 2 | 1 | 1 | 2 | 2 | - | 1 | 2 |
| CO6 | 1 | 2 | - | 2 | 2 | 3 | - | - | 2 |
| CO7 | 2 | 1 | - | 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 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 require students to apply these concepts to complex problems in electronic network simplification. CO6 and CO7 require students to develop a deep understanding MATLAB Programming.

**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 require students to use their knowledge for Network simplification in complex electronic engineering problems. CO6 and CO7 require students to think critically about MATLAB programing for simplifying the problem of critical design.

**PO3: Social competence**

CO1, CO2 and CO5: Students will able to use various transformation methods 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, CO3, CO4 and CO5 require students to learn how to use mathematical modeling, transformation method use for simplification and verify the result for complex circuit. CO6 and CO7 requires student to develop their ability to create MATLAB program for simplification of complex network and analysis of system performance.

**PO5: Trans-disciplinary knowledge**

All the COs contribute to the development of students' trans-disciplinary knowledge. CO2, CO3, CO4 and CO5 require students to learn how to apply mathematical models to problems in electronics and physics using mathematical modeling and transformation method. CO6 and CO7 require developing algorithm for problem solving in in physics and engineering technology.

**PO6: Personal and professional competence**

CO4, CO5, CO6, CO7, and CO8 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**

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

**PO9: Self-directed and Life-long learning**

CO2, 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 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.

# PSEL112: Integrated Circuit Analysis

**[Credit 04]**

**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 wide band 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 study the active and passive filter.

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

CO1. Explain concept of basic semiconductor devices.
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. Explain data converter.
CO6. Use of Op-Amp for various application.
CO7. Performance of various filter and its use.

**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, frequency response of multistage amplifiers, different coupling schemes, gain of multistage amplifiers.

**Unit-3: Tuned Amplifier and Oscillators (10L)**

**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 **.**
**Data converters:- 1)**ADC – types , characteristic **2)**DAC- types , characteristic.

**Unit-4: Operational Amplifiers and their Applications (20L)**

**Opamp -** Practical consideration in opamp based circuit design

**Opamp parameters-** dc and low frequency parameters and their significance in design of opamp, closed loop stability analysis and frequency compensation.
**Opamp application**- 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. Digital Switching Circuits, Millman Taub, TMH.
9. Electronic devices, Allen Motershed, PHI.
10. Integrated electronics, Millman Halkies, McGraw Hill.


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

**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 behaviour 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 and CO5 require students to think critically about semiconductor behaviour of different components, effect of temperature, data converter and use of operational amplifiers. CO3 and CO7 require students to use their knowledge for filter and oscillator design.

**PO3: Social competence**

CO1, CO2 and CO6: Students will able to design electronic circuits using various ICc 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. CO3 and CO7 for Oscillator and filter response analysis for scientific temper.

**PO5: Trans-disciplinary knowledge**

CO1, CO2 and CO6 contribute to the development of students' trans-disciplinary knowledge. CO1, CO2 require students to learn how to use semiconducting material for electronics and physics for sensing application, device for circuit design. CO6 require developing op-amp based circuit for problem solving in in physics and engineering and agriculture applications..

**PO6: Personal and professional competence**

CO1 and CO3 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 for system design using semiconducting devices.

**PO8: Environment and Sustainability**

CO1 and CO4: Student will think to develop simplified system for diver’s application for monitoring and controlling the parameters.

**PO9: Self-directed and Life-long learning**

CO1, CO3, 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.

## PSEL113 : Digital System Design using Verilog [Credit-4]

**Course Objectives:**

1. To understand sequential and combinational logic design techniques
2. To introduce VERILOG
3. To learn various digital circuits using VERILOG
4. To learn Programmable Devices and their applications
5. To learn various digital circuits using VERILOG
6. To learn FSM.
7. To understand memory Concept

**Course Objectives:**

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 code for various application.

**Unit-1: HDL for Digital System Design** **10L**

**VERILOG:** design flow, EDA tools, data types, modules and ports, operators, gate level 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 Code 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**

Need of PLD, architecture of simple PLD (SPLD)-PAL, PLA, ComplexProgrammable 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, 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,
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, 2nd Edn,
4. Digital design; Principles Practices, Wakerly, PHI.
5. Modern Digital Electronics, R.P Jain, McGraw Hill.
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 | 2 | 3 | 2 | 3 | 2 | 1 | 3 |
| CO2 | 1 | 1 | 1 | 3 | 3 | - | 1 | - | - |
| CO3 | - | 3 | - | 2 | - | 1 | - | - | - |
| CO4 | 3 | 2 | - | 2 | - | - | 2 | 1 | 2 |
| CO5 | 1 | 1 | - | 3 | - | - | - | - | - |
| CO6 | - | - | - | 1 | 2 | - | - | - | - |
| CO7 | 2 | 1 | - | - | - | - | 1 | - | 1 |

## Justification for the mapping

### PO1: Disciplinary Knowledge

C01: Understanding the basic language features of Verilog HDL contributes to disciplinary knowledge in the field of digital design.

CO2: Knowing various modeling techniques for combinational and sequential circuits contributes to disciplinary knowledge by providing insights into different ways to represent and design these fundamental components of digital systems.

CO4: Constructing combinational circuits using discrete gates and programmable logic devices is a practical application of knowledge in digital design.

CO5: Describing Verilog models for sequential circuits and test pattern generation involves applying knowledge of Verilog HDL to design and simulate sequential circuits

CO7:Designing Finite State Machine (FSM) code for various applications involves applying knowledge of sequential circuit design.

**PO2: Critical Thinking and Problem solving**

CO1 to CO7 (Expect CO6):All include Critical Thinking and Problem solving.

**PO3: Social competence**

C01: Understanding the basic language features of Verilog HDL contributes to Social competence in the field of digital design.

CO2: Knowing various modeling techniques for combinational and sequential circuits contributes to Social competence by providing insights into different ways to represent and design these fundamental components of digital systems.

**PO4: Research-related Skills and Scientific Temper**

CO1 to CO6: All include Research-related Skills and Scientific Temper

**PO5: Trans-disciplinary knowledge**

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

CO2: Knowing various modeling techniques for combinational and sequential circuits contributes to Trans-disciplinary knowledge.by providing insights into different ways to represent and design these fundamental components of digital systems.

CO6: Design semiconductor memory include Trans-disciplinary knowledge.

**PO6: Personal and professional competence**

CO1: Understanding the basic language features of Verilog HDL contributes to Personal and professional competence in the field of digital design.

CO3: Knowledge of logic include Personal and professional competence

**PO7: Effective Citizenship and Ethics**

CO1: Understanding the basic language features of Verilog HDL contributes to Effective Citizenship and Ethics in the field of digital design.

CO2: Knowing various modeling techniques for combinational and sequential circuits contributes to Effective Citizenship and Ethics by providing insights into different ways to represent and design these fundamental components of digital systems.

CO4: Constructing combinational circuits using discrete gates and programmable logic devices is a practical application of Effective Citizenship and Ethics in digital design.

CO7: Designing Finite State Machine (FSM) code for various applications involves Effective Citizenship and Ethics of sequential circuit design.

**PO8: Environment and Sustainability**

CO1: Understanding Verilog HDL and its role in digital logic design contributes to environmental sustainability by promoting efficient hardware design

CO4: Constructing combinational circuits with a focus on discrete gates and programmable logic devices allows for the creation of energy-efficient hardware, aligning with principles of environmental sustainability.

**PO9: Self-directed and Life-long learning**

CO1: Understanding the basic language features of Verilog HDL and its role in digital logic design is foundational knowledge

CO4: The ability to construct combinational circuits using discrete gates and programmable logic devices reflects hands-on skills.

CO7: Designing Finite State Machine (FSM) code for various applications involves applying knowledge in diverse contexts

## PSEL114: Advanced 'C' & JAVA Programming.
## Credit-(04)

**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 and interfacing.
7. To learn concepts of object oriented programming in JAVA.

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

CO1.Basic concept of C
CO2: Develop a C program
CO3: Basic and program of Graphics
CO4:Concept of JAVA and its programming.
CO5: Read, understand and trace the execution of programs written in C language.
CO6: Write the C code for a given algorithm.
CO7: Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.
CO8: Write programs that perform operations using derived data types.

**Unit-1: Introduction to 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, C Programming examples.

**Interfacing:** interfacing to external hardware, via serial/parallel port using C, parallel port functions, interfacing with LED and seven segment display, applying C to electronic circuit problems.

**Unit-3: Graphics in C** **15L**

**Graphics in C**: graphics-video modes, video adapters, C Graphics functions, arc bar circle, bar3D, rectangle, ellipse, drawpoly, fillellipse, fillpoly, Getbkcolor etc. drawing various objects and electronic components on Screen.

**Unit-4 Introduction to JAVA** **15L**

Introduction to object oriented programming, objects, Classes, inheritance, polymorphism, overloading. Operators, Input in JAVA, mathematical library methods, Conditional and Iterative constructs, Programming examples

**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. Java: A Beginner's Guide, Eighth Edition ,Herbert Schildt, McGraw-Hill Education.
5. **Java - The Complete Reference**, Herbert Schildt 11th Edition, McGraw Hill Education
6. 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 | 2 | 2 | - | - | 3 |

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**

CO1,CO2, CO5: Establishing a foundational skill set in computer programming principles, essential for a comprehensive understanding of the discipline.
CO3: Integrating principles from computer science into the broader context of visual communication and multimedia, fostering a more comprehensive understanding of the field.
CO4: Providing a holistic view of different programming languages and their application in software development.
CO6: Emphasizing algorithmic problem-solving skills, a fundamental aspect of computer science, contributing to a deeper understanding of computational processes.
CO7: Enhances disciplinary knowledge by delving into advanced programming concepts and practices, enriching the understanding of low-level programming.

**PO2: Critical Thinking and Problem Solving:**

CO1,CO2.CO5: Requiring students to solve programming challenges, enhancing their problem-solving skills in a computational context.
CO3: Challenging students to solve problems related to visual communication, multimedia, and graphical representation in a programming environment.
CO4: Enhances critical thinking by requiring students to analyze and compare programming languages, fostering a deeper understanding of diverse programming paradigms.
CO6,CO7: Writing C code for algorithms and implementing programs with advanced features such as pointers and arrays requires critical thinking and problem-solving skills, challenging students to design efficient and effective solutions.

**PO3: Social competence**

CO1,CO2.CO5: Fostering effective communication and collaboration skills in a programming environment.
CO3: Encouraging collaborative work on visual communication projects, emphasizing teamwork and effective communication to achieve shared goals in multimedia programming.
CO4: Promoting collaborative learning experiences, where students can share insights and problem-solving approaches in a social setting.
CO6,CO7: Encouraging collaboration in problem-solving, code development, and the use of pre-processing techniques in a team environment.

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

CO1,CO2.CO5. Fostering a systematic and analytical approach to programming challenges, contributing to a scientific temper in problem-solving.
CO3: Promoting inquiry into visual communication methods, multimedia programming techniques, and scientific inquiry into effective graphical representation.
CO4: Cultivate research-related skills by encouraging systematic analysis and comparison of programming languages, fostering a scientific approach to software development.
CO6,CO7: Necessitating a structured and investigative approach to programming challenges, fostering a scientific temper in problem-solving.

**PO5: Trans-disciplinary knowledge**

CO1,CO2.CO5: Providing foundational programming skills that can be applied across various domains and disciplines.
CO3: Integrating principles from computer science into the broader context of visual communication, multimedia, and graphical representation, fostering a more comprehensive understanding that spans multiple disciplines.
CO4: Exposing students to different programming paradigms and languages, enhancing their adaptability and versatility in various technological contexts.
CO6,CO7: Providing skills that can be applied in diverse programming scenarios and technological contexts, fostering adaptability and versatility.

**PO6: Personal and professional competence:**

CO1,CO2.CO5: Acquiring a basic understanding of C and engaging in activities such as program development and execution analysis contribute to personal and professional competence by building foundational programming skills essential for a successful career in the field.
CO3: Providing skills in visual communication and multimedia programming, making individuals more versatile and competent in the professional landscape.
CO4: Providing a broad skill set, making individuals adaptable to different programming languages and environments.
CO6,CO7: Equipping individuals with versatile programming skills, enhancing their capability to address complex computational challenges.

**PO9: Self-directed and Life-long learning**

CO1,CO2.CO5: Encouraging students to explore programming independently, setting the foundation for lifelong learning in the rapidly evolving field of software development.
CO3: Understanding graphics programming promotes self-directed learning as students delve into multimedia programming, encouraging ongoing exploration of graphical representation techniques and applications throughout their professional journey.
CO4: Cultivates self-directed learning by fostering adaptability and a lifelong commitment to acquiring new programming languages and paradigms.
CO6,CO7: Writing C code for algorithms and implementing programs with advanced features involves self-directed learning as students explore complex programming concepts, encouraging ongoing skill development and a commitment to lifelong learning in programming.

# PSEL115: Electronic Science Practical Course - I

## [Credit-4]

**Group A:** Analog Circuit Design = 7

**Group B:** Digital Electronics = 3

**Group C:** Activity = 2

**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 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 analysis
**CO7.** Capability to develop experimental skills to design hobby project

**[A] Practical based on Circuit Design**

1. Bootstrap ramp generator for delay triggering
2. Tuned amplifier small signal / large signal for IF
3. Voltage controlled current source / sink and current mirror and doubler
4. Comparator and Schmitt trigger with single supply operation
5. Second order Butterworth filters (BP and BR)
6. Waveform generation: Quadrature Oscillator, Bubba Oscillator
7. V to F and F to V using commercially available IC
8. Instrumentation amplifier for a given gain
9. Low current negative power supply using IC555 / dual power supply using single battery
10. PLL characteristics and demonstrate any one application (IC565/CD4046)
11. Design RC phase shift oscillator using op-amp for frequency ________
12. Design Wien-bridge oscillators using op-amp for frequency ________
13. To design and set up an integrator and differentiator circuit using op-amp

14. Analog to Digital Convertor.

**[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
9. Design a mod-- synchronous counter using JK flip flop.
10. Design full adder using MUX

**[C] Activity:** Equivalent to TWO Experiments

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

CO2, CO3 and CO6: 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. 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 and CO4 required to student for thinking development of analog or digital circuit for simplified practical problems for energy conservation, soil, water or environment parameter monitoring. CO7 required developing hobby project for preservation.

**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.

# PSEL116: Electronic Science 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 analog circuits and simulation.
6. To understand the use of MATLAB for filter and transfer function design.
7. To learn C program for differential equations.

**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/ PSPICE 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 = 6

**Group B:** Mathematical Methods for Electronics (C/MATLAB/PSPICE) = 4

**Group C:** Activity = 2

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

1. Combinational Logic
   a. Parity Generator and checker
   b. Hamming Code Generator
   c. Manchester code Generator
2. Sequential Logic
   a. Up-down bit binary counter (minimum 4-bit)
   b. Universal shift register
3. Four bit ALU design (structural modelling)
4. Keyboard Scanning
5. Designing of Traffic light Controller
6. Implementation of 8 bit multiplexer
7. LCD controller
8. Code Converter (BCD to seven Segments)
9. State machine (Stepper sequence generator/Vending Machine/ Washing Machine)
10. Barrel shifter

**[B] Practical based on C / MATLAB / PSPICE**

1. Phase and frequency response of a CT system: Low Pass and High Pass
2. Phase and frequency response of a DT system: Low Pass and High Pass
3. Transient and steady state response of CT system: LCR series circuit
4. Simulation of transfer function using poles and zeros
5. Synthesis of periodic waveform from Fourier coefficients
6. Solution of differential equation with given boundary conditions
7. Analysis of a given dc electrical circuit
8. Effect of locations of poles and zeros on the transfer function and corresponding frequency response
9. Laplace transform of given function ……

**[C] Activity:** Equivalent to TWO Experiments

OR

Circuit Simulation Using Software

| 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 | 2 | 2 | - | 1 | 3 |
| CO4 | 3 | 3 | 1 | 3 | 2 | 2 | - | 1 | 3 |
| CO5 | 3 | 3 | 1 | 3 | 2 | 2 | - | 1 | 3 |
| CO6 | 3 | 3 | 1 | 3 | 1 | 2 | 1 | 1 | 3 |
| CO7 | 2 | 2 | 1 | 3 | 2 | 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.

**PO7: Effective Citizenship and Ethics**

CO6,CO7: Developing soft skills and self-employability knowledge aligns with effective citizenship and ethics, as it prepares individuals to contribute responsibly to society, either through meaningful employment or entrepreneurial endeavors.

**PO8: Environment and Sustainability**

CO1,CO2: 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, CO5, CO6, CO7: Reflects an understanding of environmental sustainability, ensuring that developments align with eco-friendly practices.

**PO9: Self-directed and Life-long learning**

CO1,CO2: 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, CO5, CO6, CO7: 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.