Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Two Year Degree Program in Electronics

(Faculty of Science & Technology)

CBCS Syllabus

M.Sc. (Electronics) Part-I Semester -I

For Department of Electronics

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

(Eligibility : B.Sc. Electronics)

Title of the Programme: M.Sc. (Electronics)

Preamble

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Electronics and related subjects, the Board of Studies in Electronics at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of M.Sc. Part-IElectronics, which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

AElectronics degree equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Post Graduates in Electronics find opportunities in various fields, including Embedded System developer, IoT, IT, AI developer, WSN,

MatLabDeveloper, PCB Designer, Communication Sector, Defence, Sensor and System developer, PLC and SCADA developer, Lab View and many other domains.

The curriculum also delves into the intricate relationship between Industry and atomization. The objectives of updating syllabi is to prepare pupils to face the current challenges in Industry and Academia, to develop strong footprint in the fundamental, specialization and recent technology. The proposed syllabus and scheme of study equip students with both basic and advance topics in the field of Electronics. In addition, the syllabus incorporate more practical and working principles, design guidelines and experimental skills associated with different semiconductor devices and circuits, underlying mathematical and analysis techniques, electromagnetic and instrumentation principles, design methodologies for digital and embedded systems, communication electronics and control systems and various applications of electronic devices, circuits and systems are among such important aspects.

Overall, revising the Electronics syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Specific Outcomes (PSOs)

PSO1: AcquiretheknowledgeinElectronicDevicesandCircuits,Analog&Digitalcommunication, Embeddedsystems, AI, WSN ,MEMSandothercoreareasof Electronics.

PSO2: Understandtheprinciplesandworkingofbothhardwareandsoftwareaspectsof Electronic systems

PSO3: Gaintheoretical andpractical knowledgeindevelopingareasofElectronics.

PSO4: Toanalyze,designandimplementanalogand digitalelectronicsystems,informationand communicationsystems.

PSO5: Assesstheimpact ofnewtechnologiesandsolvecomplex problems.

PSO6: Developresearchorientedskillsandtoinculcatelaboratoryskillsinstudentssothattheycan takeupindependent projects.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Electronics

From 2022-23 to 2024-25

Sr.No.	Name	Designation
1.	**Dr. Deshpande J.D.**	**Chairman**
2.	**Dr. Mrs. Pawar A. M.**	**Member**
3.	**Dr. Patil S. N.**	**Member**
4.	**Mrs. Rupanawar P. D.**	**Member**
5.	**Dr. Kothawale A. S.**	**Member**
6.	**Mrs. Gawade S. A.**	**Member**
7.	**Mrs. Patil S. S.**	**Invitee**
8.	**Mrs. Shinde P. K.**	**Invitee**
9.	**Mrs. Adsul K. R.**	**Invitee**
10.	**Prof. Dr. S. R. Kumbhar**	**Expert from other University**
11.	**Dr. SadistapShashikant**	**Expert from other University**
12.	**Dr. MudassarShaikh**	**Expert from University**
13.	**Mr. Patil Sharad. V.**	**Industry Expert**
14.	**Miss. SalunkheYogita.**	**Meritorious Alumni**
15.	**Miss EkatpureArti**	**Student Representative**
16.	**Mr. KhaireKiran**	**Student Representative**

Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati (Autonomous)

Credit Distribution Structure for (M.Sc. Electronics) Part-I (2023 Pattern)

Year	Level	Sem.	Major		Research Methodology (RM)	OJT/ FP	RP	Cum. Cr.
			Mandatory	Electives				
I	6.0	Sem-I	ELE-501-MJM:MathematicalMethodsinElectronics and Network Analysis (Credit 04) ELE-502-MJM:Integrated Circuit Analysis. (Credit 04) ELE-503-MJM:Electronics Science Practical Course -I (Credit 02) ELE-504-MJM:Electronics Science Practical Course -II (Credit 02)	ELE-511-MJE(A): Digital System Design using Verilog. **(Credit04)** ELE-511-MJE(B): Advanced 'C' and JAVA Programming. **(Credit04)**	ELE-521-RM Research Methodology (**Credit 04**)	--	--	**20**
		Sem- II	ELE-551-MJM:Electromagnetics, Microwave and Antennas.(Credit 04) ELE-552-MJM: Embedded System Design with PIC Microcontroller. (Credit 04) ELE-553-MJM::Electronics Science Practical Course -III (Credit 02) ELE-554-MJM::Electronics Science Practical Course - IV (Credit 02)	ELE-561-MJE(A): Instrumentation and Measurement Techniques. **(Credit04)** ELE-561-MJE(A): Foundation of Semiconductor Devices (**Credit04**)	--	ELE-581-OJT/FP **Credit 04**	--	**20**
Cum. Cr.			**24**	**8**	**4**	**4**	**--**	**40**

*** 1 Credit = 15 hr.**

Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati (Autonomous)

Course Structure for (M.Sc. Electronics) Part-I (2023 Pattern)

Sem.	Course Type	Course Code	CourseTitle	Theory/ Practical	No.of credits
I	Major (Mandatory)	ELE-501-MJM	Mathematical Methods in Electronics and Network Analysis	Theory	04
	Major (Mandatory)	ELE-502-MJM	Integrated Circuit Analysis	Theory	04
	Major (Mandatory)	ELE-503-MJM	Electronics Science Practical Course -I	Practical	02
	Major (Mandatory)	ELE-504-MJM	Electronics Science Practical Course -II	Practical	02
	Major (Elective)	ELE-511-MJE(A)	DigitalSystemDesignusingVerilog	Theory	04
		ELE-511-MJE(B)	Advanced 'C' & JAVA Programming.	Theory	
	Research Methodology (RM)	ELE-521-RM	Research Methodology	Theory	04
			Total credits Semester I		**20**
II	Major (Mandatory)	ELE-551-MJM:	Electromagnetics, Microwave and Antennas.	Theory	04
	Major (Mandatory)	ELE-552-MJM:	Embedded System Design with PIC Microcontroller.	Theory	04
	Major (Mandatory)	ELE-553-MJM:	Electronics Science Practical Course -III	Practical	02
	Major (Mandatory)	ELE-554-MJM:	Electronics Science Practical Course - IV	Practical	02
	Major (Elective)	ELE-561-MJE(A)	Instrumentation and Measurement Techniques.	Theory	04
	Major (Elective)	ELE-561-MJE(B)	Foundation of Semiconductor Devices	Theory	
	On Job Training (OJT)/Field Project (FP)	ELE-581-OJT/FP	On Job Training Filed Project	Training/Project	04
			Total credits Semester II		**20**
			Cumulative Credits Semester I and II		**40**

CBCS Syllabus as per NEP 2020 for M.Sc. I (2023 Pattern)

Name of the Programme: M.Sc.Electronics

Programme Code: PSELE

Class: M.Sc. I

Semester: I

Course Type: Major Mandatory (Theory)

Course Code: ELE-501-MJM

Course Title **:** Mathematical Methods in Electronics and Network Analysis

No. of Credits: 04

No. of Teaching Hours **:** 60

Course Objectives:

1. To learn the methods of analysis for CT and DT signals and systems
2. To learn concept of mathematical modeling of simple electrical circuits
3. To get familiar with role of differential equations in applied electronics
4. To know about mathematical tools and techniques for network analysis

Course Outcomes:

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

CO1. From this course, the students are expected to learn some mathematical techniquesrequiredto understand theElectronics phenomenaatthepostgraduate 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. Analyze the circuit using Kirchhoff's law and Network simplification theorems
CO5. System analyze using MATLB
CO6. To solve problem based on network theorems

Topics and Learning Points

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 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.

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).

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,ShyamMohanandS. 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

CBCS Syllabus as per NEP 2020 for M.Sc. I (2023 Pattern)

Name of the Programme: M.Sc.Electronics

Programme Code: PSELE

Class: M.Sc. I

Semester: I

Course Type: Major Mandatory (Theory)

Course Code: ELE-502-MJM

Course Title **:** Integrated Circuit Analysis

No. of Credits: 04

No. of Teaching Hours **:** 60

Course 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

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 concept of Circuit&Theorems.
CO6. Understand the basic material and properties of semiconductors
CO7. Explore constructional features and I-V characteristics of of basic semiconductor devices diode, Transistors
CO8. Apply basic concepts of P-N junction in developing simple application circuits

Topics and Learning Points

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.

References:

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, MillmanTaub, TMH.
9. Electronic devices, Allen Motershed, PHI.
10. Integrated electronics, MillmanHalkies, McGraw Hill.

CBCS Syllabus as per NEP 2020 for M.Sc. I (2023 Pattern)

Name of the Programme: M.Sc.Electronics

Programme Code : **PSELE**

Class : M.Sc. I

Semester : I

Course Type : Major Mandatory(Practical)

Course Code : ELE-503-MJM

Course Title : Electronic Science Practical Course -I

No. of Credits: 02

No. of Teaching Hours : 60

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, analyzing the results and interpret data.
CO8. Develop hobby projects.

Topics and Learning Points(Perform any 8 experiments)

1. Boot strap ramp generator for delay triggering
2. Tuned amplifier smallsignal/large signal orIF
3. Voltage controlled current source/sink and current mirror and doubler
4. Comparator and Schmitt trigger with single supply operation
5. SecondorderButterworthfilters(BPand BR)
6. VtoFandFtoVusingcommerciallyavailableIC
7. Instrumentation amplifier for a given gain
8. Low current negativepower supplyusingIC555/dual powersupplyusingsinglebattery
9. Design RC phase shift oscillator using op-amp for frequency _____
10. Design Wien-bridge oscillators using op-amp for frequency _____
11. To design and set up an integrator and differentiator circuit using op-amp
12. Analog to Digital Convertor.

13. Twodigitcombinationallock
14. Keyboardencoderwithlatches
15. Trafficlightcontroller
16. Multiplexeddisplay(Banktoken / twodigit counter)
17. Bidirectionalsteppermotorcontrol(SequenceGenerator)
18. OnedigitBCDadderand8-bitadder/subtractor
19. Objectcounter (useofMMV,counter)
20. Binary-GrayandGray-Binarycode converter
21. Design a mod-- synchronous counter using JK flip flop.
22. Design full adder using MUX

Activity: (Any one Activity equivalent to two experiments)

Students must perform at least one additional activity out of two activities in addition
to eight experiments mentioned above. Total Laboratory work with additional activities
should be equivalent to ten experiments.

- Industrial Visit / Study Tour / Field visit

CBCS Syllabus as per NEP 2020 for M.Sc. I (2023 Pattern)

Name of the Programme: M.Sc.Electronics

Programme Code: PSELE

Class: M.Sc. I

Semester: I

Course Type: Major Mandatory(Practical)

Course Code: ELE-504-MJM

Course Title **:** Electronic Science Practical Course -II

No. of Credits **:** 02

No. of Teaching Hours **:** 60

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.

Topics and Learning Points (Perform any 8 experiments)

1. Combinational Logic
   a. ParityGenerator and checker
   b. HammingCodeGenerator
   c. ManchestercodeGenerator
2. Sequential Logic
   a. Up-down bit binarycounter(minimum 4-bit)
   b. Universalshiftregister
3. Four bit ALU design(structural modelling)
4. KeyboardScanning
5. Designingof TrafficlightController
6. Implementation of 8bitmultiplexer
7. LCDcontroller
8. CodeConverter(BCDto sevenSegments)

9. Statemachine(Steppersequence generator/VendingMachine/WashingMachine)
10. Barrelshifter
11. Phaseand frequencyresponseofaCTsystem:LowPass andHigh Pass
12. PhaseandfrequencyresponseofaDT system:Low PassandHigh Pass
13. TransientandsteadystateresponseofCTsystem:LCRseries circuit
14. Simulation of transfer function using poles and zeros
15. Synthesis of periodic waveform from Fourier coefficients
16. Solution of differential equation with given boundary conditions
17. Analysis of a given dc electrical circuit
18. Effectoflocationsofpolesandzerosonthetransferfunctionandcorrespondi ngfrequencyresponse
19. Laplace transform of given function ……

Activity: (Any one Activity equivalent to two experiments)

Students must perform at least one additional activity out of two activities in addition

to eight experiments mentioned above. Total Laboratory work with additional activities

should be equivalent to ten experiments.

CBCS Syllabus as per NEP 2020 for M.Sc. I (2023 Pattern)

Name of the Programme: M.Sc.Electronics

Programme Code: PSELE

Class: M.Sc. I

Semester: I

Course Type: Elective (Theory)

Course Code: ELE-511(A)-MJE

Course Title **:** Digital System Design using Verilog

No. of Credits: 04

No. of Teaching Hours **:** 60

Course Objectives:

1. To understand sequential and combinational logic design techniques
2. To introduce VERILOG
3. To learn various digital circuits usingVERILOG
4. To learn Programable Devices and their applications

Course Outcomes:

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 embedded systems using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores.
CO8. Synthesize different types of processor and I/O controllers that are used in embedded system.

Topics and Learning Points

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 VHDLlanguage.

Unit-2:Combinational Logic 15L

Introductiontocombinationalcircuits,realizationofbasiccombinationalfunctions-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 wave forms, 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

NeedofPLD,architectureofsimplePLD(SPLD)-PAL,PLA,ComplexProgrammableLogicDevice(CPLD)andFieldProgrammableLogic 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.

References:

1. Verilog HDL; A Guideto Digital Design and Synthesis,SamirPalnitkar,Pearson Education,
2. Verilog HDL synthesis; A Practical Primer,J.Bhaskar,StarGalaxyPublishing,1998.
3. DigitalSystemDesignwithVERILOGDesign,StephenBrown,ZvonkoVranesic,TMH,2ndEd
4. Digital design; Principles Practices, Wakerly,PHI.
5. Modern Digital Electronics, R.PJain,McGrawHill.
6. Digital systems; Principles and Applications ,Tocci, Pearson Education.
7. Digital Logic and Computer Design ,Morris Mano, PHI.

CBCS Syllabus as per NEP 2020 for M.Sc. I (2023 Pattern)

Name of the Programme: M.Sc.Electronics

Programme Code: PSELE

Class: M.Sc. I

Semester: I

Course Type: Elective (Theory)

Course Code: ELE-511(B)-MJE

Course Title **:** Advanced 'C' & JAVA Programming

No. of Credits: 04

No. of Teaching Hours **:** 60

Course Objectives:

1. To understand basic concepts of C programming language.
2. To learn various advanced features, graphics and interfacing.
3. 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 Jawa 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.

Topics and Learning Points

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

References/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 ,HerbertSchildt, McGraw-Hill Education.
5. **J**ava - The Complete Reference**,**Herbert Schildt 11th Edition, McGraw Hill Education
6. Programming in C, Stephen G. Kochan. CBS.

CBCS Syllabus as per NEP 2020 for M.Sc. I (2023 Pattern)

Name of the Programme: M.Sc.Electronics

Programme Code: PSELE

Class: M.Sc. I

Semester: I

Course TypeResearch Methodology (RM) (Theory)

Course Code: ELE-521-RM

Course Title **:** Research Methodology

No. of Credits: 04

No. of Teaching Hours **:** 60

Course Objectives:

1. To understand basic concepts of Research.
2. To learn different identification and formulation.
3. To understand concept of research design.
4. To study qualitative and quantitative research concept.
5. To learn data collection technique.

Course Outcomes:

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

CO1. Students who complete this course will be able to understand and comprehend the basics in research methodology and applying them in research/ project work.

CO2. This course will help them to select an appropriate research design.

CO3. The Students will develop skills in qualitative and quantitative data analysis and presentation.

CO4. The course will also enable them to collect the data, edit it properly and analyse it accordingly. Thus, it will facilitate students' prosperity in higher education.

CO5. Students will be able to demonstrate the ability to choose methods appropriate to research objectives.

CO6. Plan a research proposal and design the research.

CO7. Understand research problem and design before initiating stage.

CO8. Comprehend and perform quantitative and qualitative data analysis.

CO9. Write research report by bearing in mind right Ethics.

Topics and Learning Points

Unit-1 **15L**

Foundation of Research: Meaning, Objectives, Motivation, Utility. Types of research: exploratory, descriptive and experimental; Significance and characteristics of research; Criteriaof good research, Concept of theory, empiricism, deductive and inductive theory.Characteristics of scientific method - understanding the language of research - Concept, Construct, definition, Variable Research Process.

Unit-2 **15L**

Problem Identification & Formulation: definition and formulating the research problem, Necessity of defining the problem, Importance of literature review, need and importanceResearch Question - Investigation Question - Measurement Issues - Hypothesis - Qualities of a good hypothesis - Null hypothesis & Alternative Hypothesis. Hypothesis Testing - Logic & importance,

Unit-3 **10L**

Research Design: Concept and Importance in Research - Features of a good research design - Exploratory Research Design - Concept, Types and uses, Descriptive Research Design - concept, types and uses. Experimental Design - Concept of Independent & Dependent variables.Qualitative and Quantitative Research: Qualitative - Quantitative Research - Concept of measurement, causality, generalization, replication. Merging the two approaches.

Unit-4 **(10L)**

Data collection: data, types of data, methods, sample and population, sampling techniques, characteristics of a good sample; Tools of data collection: observation method, interview, questionnaire, various rating scales, characteristics of good research tools.

Data analysis: Univariate analysis: frequency tables, bar charts, piecharts, percentages; Bivariate analysis: cross tabulations and Chi-square test.

Unit-5 **(15L)**

Research writing: Report: definition, importance,types; Research paper writing: methods& style; Seminar & conference paper writing;Synopsis writing: methods; Thesis/Project writing: structure & importance; 7 Cs of effective research writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Research evaluation methods; Index: h-index, I-index; Plagiarism: significance and effects, citation and acknowledgement; Intellectual property right: copyright, royalty, patent law;Research ethics.

Reference Books:

1. Kothari, C. R., 2004. Research Methodology: Methods and Techniques. New Age International.
2. Research Methodology: An Introduction - Stuart Melville and Wayne, 2014. 2nd ed edition, Juta Academic.
3. Practical Research Methods - Catherine Dawson, 2002.
4. Sinha, S. C. and Dhiman, A. K., 2002. Research Methodology, Ess Publications.
5. Garg, B. L., Karadia, R., Agarwal, F. and Agarwal, U. K., 2002. An introduction to Research Methodology, RBSA Publishers.
6. Trochim, W. M. K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing.
7. Wadehra, B. L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.
8. Select references from the Internet

Examination Pattern / Evaluation Pattern

Teaching and Evaluation (for Major, Minor, AEC, VEC, IKS courses)

Course Credits	No. of Hours per Semester Theory/Practical	No. of Hours per Week Theory/Practical	Maximum Marks	CE 40 %	ESE 60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	4 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Teaching and Evaluation (for VSC, SEC & CC courses)

- Evaluation to be done by Internal & External Experts
- No descriptive end semester written examination
- Evaluation to be done at Department level preferably prior to commencement of Theory /Practical Examinations
- Evaluation to be done on the Skills gained by student