MODERN EDUCATION SOCIETY'S

NOWROSJEE WADIA COLLEGE, PUNE -01

(An Autonomous college affiliated to Savitribai Phule Pune University)

M.Sc. I Electronic Science

SYLLABUS

UNDER NATIONAL EDUCATION POLICY 2020

TO BE IMPLEMENTED FROM

ACADEMIC YEAR 2023-24

(Faculty of Science and Technology)

Structure of Course

Basic structure/pattern (Framework) of the proposed postgraduate syllabus for the two-year integrated course leading to M.Sc. (Electronic Science).

Course Structure includes 2 compulsory theory courses of 4 credits each, Elective Theory courses of 4 credits and 2 compulsory practical courses of 2 credits as well for each semester.

In addition to this, one Elective theory course of 4 credits is to be chosen from the given list for optional course.

One Research Methodology course and OJT for semester I and II respectively.

Preamble:

Electronics technology has revolutionized various fields including communication, consumer appliances, medical, defense and so on. The advances in technology are making systems smaller, smarter and powerful. Electronics is an important branch of Science devoted to design implementation and analysis of circuits and systems. Knowledge of Electronics is based on fundamental laws of Physics and though new chips/SOC's are fabricated every day, basic principles remain the same.

The goal of the two-year course is to instill in students a confidence that they can get a grip of the subject and apply it for designing, testing and analyzing systems. The course will also make use of problem-solving approach wherein the students will be trained to apply the acquired knowledge to design and analyze circuits for specific applications. The students will be familiarized with programming languages, various development tools, modeling and simulation tools through lab sessions.

The syllabus has been designed such that basic fundamental concepts, knowledge and specific practical skills of the students are developed. The students will learn mathematical methods in electronics, they will develop circuits by using analogue and digital circuit design they will also acquire knowledge of PIC, AVR, Arduino, Raspberry Pi.

Course Outcome:

The course aims to generate trained manpower with adequate theoretical and practical knowledge of the various facets of electronic circuits and systems. In this course, the students will get a comprehensive understanding of electronic devices and circuits. To acquaint the students with the fundamental principles of various devices is one of the principle objectives of this course. The student will get profound knowledge to design electronic circuits and conduct investigations, as well as to analyse and interpret data.

They will develop the ability to use current techniques, skills, and modern tools necessary for practice.

Following are the objectives -

i. To design the syllabus with specific focus on key Learning Areas.

ii. To equip student with necessary fundamental concepts and knowledge base.

iii. To develop specific practical skills.

iv. To impart training on circuit design, analysis, building and testing.

v. To prepare students for demonstrating the acquired knowledge.

vi. To encourage student to develop skills for accepting challenges of upcoming technological advancements.

Program Specific Objectives:

i. To nurture academicians with focus and commitment to their subject

ii. To shape good and informed citizens from the students entering into the program.

iii. To credit a skilled workforce to match the requirements of society.

iv. To impart knowledge of science is the basic objective of this Programme.

v. To develop a scientific attitude is the major objective to make the students open-minded, critical and curious.

vi. To develop skills in practical work, experiments, and laboratory materials and equipment along with the collection and interpretation of scientific data to contribute to science.

Program outcomes:

i. The students will Postgraduate with proficiency in the subject of their choice.

ii. The students will be eligible to continue higher studies in their subject.

iii. The students will be eligible to pursue higher studies abroad.

iv. The students will be eligible to appear for the examinations for their jobs in government organizations.

v. The students will be eligible to apply for jobs with a minimum requirement of a M. Sc. Programme.

vi. The students will become entrepreneur.

Eligibility:

1) Electronics as one of the subjects at the second year B.Sc. level, B.Sc. (IT), B.E. (Electronics/ Electronics and Telecommunication/ Electrical/ Instrumentation/ IT), and B.Sc. General with one of the subjects as Electronics.
2) One of the minor subjects till second year B.Sc. in NEP.

COURSE STRUCTURE M. Sc. I

Course Type	Course	Course / Paper Title	Hours / Week	Credit
Semester I				
Major Mandatory	Major Paper 1 (Theory)	Advanced Analog Circuit Design	4	4
	Major Paper 2 (Theory)	Advanced Digital Circuit Design	4	4
	Major Paper 3 (Theory)	Instrumentation and Measurement Techniques	2	2
	Major Paper (Practical)	Practical Course I	4	2
	Major Paper (Practical)	Practical Course II	4	2
Major Elective	Elective - I	Mathematical methods for Electronics using C	2	2
	Elective - II	Advanced Microcontrollers	2	2
	Major Elective -I (Practical)	Mathematical methods for Electronics using C – Lab	4	2
	Major Elective -II (Practical)	Advanced Microcontrollers - Lab	4	2
		Research Methodology	4	4
Semester II				
Major Mandatory	Major Paper 1 (Theory)	Applied Electromagnetics, Microwaves and Antennas	4	4
	Major Paper 2 (Theory)	Foundation of Semiconductor Devices	4	4
	Major Paper 3 (Theory)	VLSI System Design	2	2
	Major Paper (Practical)	Practical Course III	4	2
	Major Paper (Practical)	Practical Course IV	4	2
Major Elective	Elective - I	Semiconductor Processing Technology	2	2
	Elective - II	32-bit Microcontroller based System Design	2	2
	Major Elective -I (Practical)	Semiconductor Processing Technology – Lab	4	2
	Major Elective -II (Practical)	32-bit Microcontroller based System Design – Lab	4	2
OJT			4	4

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Theory) Subject-I		
YEAR-I	**Name of Paper- Advanced Analog Circuit Design** **Subject Code: PELMJ-111**	**CREDITS-4**
SEMESTER-I		**HOURS-60**

Course specific outcomes-

1. *Student will study the characteristics and working of electronic devices*
2. *Student will able to put the various device models*
3. *Student will design the wideband and narrowband amplifiers using BJT*
4. *Student will develop skills in analysis and design of analog circuits*
5. *Student will design opamp applications*

Sr no	**COURSE CONTENT / SYLLABUS**	**Lectures**
UNIT I	**Basic Semiconductor Devices** 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 Construction of JFET, types and its operation, parameters of JFET, JFET characteristics, comparison of BJT and JFET, JFET amplifiers MOSFET, depletion and enhancement, biasing of MOSFET, applications	**15**
UNIT II	**Frequency Response of Amplifiers** BJT models and modeling parameters, equivalent circuits for CE, CB and CC configurations, single stage amplifier, small signal analysis, distortion Design of single stage RC-coupled amplifier with frequency response (f1 and f2) Frequency Response: Low and High frequency equivalent circuit, bode plots, Miller effect, square wave testing, frequency response of multistage amplifiers, different coupling schemes and gain of multistage amplifiers	**15**
UNIT III	**Tuned Amplifier and Oscillators** 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	**15**

UNIT IV	**Operational Amplifiers and their Applications** 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.	**15**
References	1. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar, 3rd Edn, McGraw Hill. 2. Electronic Devices and Circuit Theory, Robert Boylestead, Louis 3. Nashelsky, PHI. 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 Company. 8. Pulse, Digital Switching Circuits, Millman Taub, TMH. 9. Electronic devices, Allen Motershed, PHI. 10. Integrated electronics, Millman Halkies, McGraw Hill	
Learning outcomes:	*After completion of this course student will be able:* 1. *To learn the characteristics and working of electronic devices* 2. *To study the various device models* 3. *To study the wideband and narrowband amplifiers using BJT* 4. *To develop skills in analysis and design of analog circuits* 5. *To study the designs of opamp applications*	

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Theory) Subject-II		
YEAR-I	**Name of Paper- Advanced Digital Circuit Design**	**CREDITS-4**
SEMESTER-I	**Subject Code: PELMJ-112**	**HOURS-60**

Course specific outcomes-

1. *Understand and represent numbers in powers of base and converting one from the other,*
2. *carry out arithmetic operations*
3. *Understand basic logic gates, concepts of Boolean algebra and techniques to reduce/simplify Boolean expressions*
4. *Analyze and design combinatorial as well as sequential circuits*
5. *Explain the concepts related to PLD's*
6. *Use VLSI design methodologies to understand and design simple digital systems & understand the HDL design flow and capability of writing programs in VHDL/Verilog*
7. *Familiar with Simulation and Synthesis Tools, Test Benches used in Digital system Design.*

Sr no	**COURSE CONTENT / SYLLABUS**	**Lectures**
UNIT I	**HDL for Digital System Design** 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	**15**
UNIT II	**Combinational Logic** 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	**15**
	Sequential Logic Design and Circuits Introduction to sequential circuits Flip Flops: types, state table, transition table, excitation tables, timing waveforms, clock generators Counters: synchronous, asynchronous, design of counters,	**15**

UNIT III	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 IV	**PLDs and Memories** 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, 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.	**15**
References:	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, 2nd Edn, 2007. 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.	
Learning outcomes:	*After completion of this course student will be able:* 1. *To understand sequential and combinational logic design techniques* 2. *To introduce VERILOG* 3. *To learn various digital circuits using VERILOG* 4. *To learn PLD, CPLD, FPGA and their applications*	

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Theory) –III		
YEAR-I	**Name of Paper- Instrumentation and Measurement Techniques** **Subject Code: PELMJ-113**	**CREDITS-2**
SEMESTER-II		**HOURS-30**

Course specific outcomes-

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

Sr no	COURSE CONTENT / SYLLABUS	Lectures
UNIT I	**Introduction to Measurement and Measurement Systems** Definition and significance of measurement, classification of instruments and types of measurement applications, elements of an instrument / measurement system, active and passive transducers, analog and digital modes of operation, null and deflection methods, input-output configuration of instruments and measurement systems, methods of correction of instruments and measurement systems Generalized performance characteristics of instruments: static characteristics and static calibration, meaning of static calibration, true value, basic statistics, least–squares calibration curves, calibration accuracy versus installed accuracy, combination of components errors in overall system accuracy calculations, theory validation by experimental testing.	**15**
UNIT II	**Static Dynamic Characteristic of Measurement System** Static sensitivity, linearity, threshold, noise floor, resolution, hysteresis and dead space, scale readability, span, generalized static stiffness and input impedance, loading effect Dynamic characteristics: generalized mathematical model of measurement system, operational transfer function, sinusoidal transfer function, zero-order instrument, first order instrument, second order instruments, step response, ramp response, frequency response of first -order instruments and second order instruments	**15**

	Errors in measurement: Types of Errors - gross, systematic, environmental errors, systemic errors, computational error, personal error etc.	
References	1. Measurement Systems, Applications and Design, Ernest O. Doeblin and Dhanesh N. Manik, 5th Edition, Tata McGraw Hill. 2. A Course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney, Dhanpat Rai & Co. 3. Electronic Instrumentation, Kalsi, TMH. 4. Modern Electronic Instrumentation and Measurements Techniques, Cooper and Helfrick, PHI.	
Learning outcomes:	*After completion of this course student will be able:* 1. *To give functional descriptions of measuring instruments* 2. *To analyse characteristics of instruments* 3. *To state the working principles of various types of sensors and transducers and their use in measuring systems* 4. *To apply the various calibration techniques involved in various types of instruments* 5. *To calibrate the designed instruments*	

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Practical)		
YEAR-I	**Name of Paper- Practical Course –I**	**CREDITS-2**
SEMESTER-I	**Subject Code: PELMJ-114**	

List of Practicals: (Any 12)

1. Second order Butterworth filters (BP and BR)
2. Waveform generation: quadrature oscillator, Bubba oscillator
3. V to F and F to V using commercially available IC
4. Instrumentation amplifier for a given gain
5. Low current negative power supply using IC555 / dual power supply using single battery
6. PLL characteristics and demonstrate any one application (IC565/CD4046)
7. Phase and frequency response from transfer function of a CT system: Low Pass and High Pass
8. Phase and frequency response from transfer function of a DT system: Low Pass and High Pass
9. Transient and steady state response of CT system: LCR series circuit with different inputs
10. Simulation of transfer function using poles and zeros
11. Synthesis of periodic waveform from Fourier coefficients
12. Solution of differential equation with given boundary conditions
13. Analysis of a given dc electrical circuit
14. Effect of locations of poles and zeros on the transfer function and corresponding frequency response.
15. Design build and test rms to dc converter for voltage measurement of ac signal
16. Displacement measurement using LVDT, signal conditioning and DPM
17. Temperature measurement using PT100, signal conditioning and DPM
18. Temperature measurement using thermocouple with cold junction compensation
19. Design build and test IR transmitter and receiver (TSOP1738 or similar) for object detection
20. To build and test current telemetry (4 to 20 mA)
21. Ultrasonic transmitter and receiver, distance measurement
22. Pressure measurement using strain gauge
23. RPM measurement using various methods
24. Design and calibrate light intensity meter using photodiode or LDR and the necessary signal conditioning and display.
25. Use of strain gauge to measure stress on a cantilever made of material known quantity
26. Hot wire anemometer.

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Master of Electronic Science		
Major (Practical)		
YEAR-I	**Name of Paper- Practical Course –II**	**CREDITS-2**
SEMESTER-I	**Subject Code: PELMJ-115**	

List of Practicals: (Any 12)

1. Binary-Gray and Gray-Binary code converter.
2. Combinational Logic.
3. Half Adder and Subtractor.
4. RS Flip Flop.
5. Parity Generator and checker.
6. Hamming Code Generator.
7. Manchester code Generator.
8. Sequential Logic.
9. Up-down bit binary counter (minimum 4-bit).
10. Universal shift register.
11. Four-bit ALU design (structural modelling).
12. Keyboard Scanning.
13. Designing of Traffic light Controller.
14. Implementation of 8-bit multiplexer.

	MODERN EDUCATION SOCIETIES NOWROSJEE WADIA COLLEGE, PUNE	**Academic Year 2024-2025**
Master of Electronic Science		
Major (Elective) – I		
YEAR-I	**Name of Paper- Mathematical methods in Electronics using C**	**CREDITS-2**
SEMESTER-I	**Subject Code: PELME-116**	**HOURS-30**

Course specific outcomes-

1. *To get familiar with role of differential equations in applied electronics.*
2. *To equip student with necessary fundamental concepts and knowledge base.*
3. *To develop specific practical skills.*
4. *To solve mathematical methods using C programming.*
5. *To impart training on circuit design, analysis, building and testing.*
6. *To prepare students for demonstrating the acquired knowledge.*
7. *To encourage student to develop skills for accepting challenges of upcoming technological advancements.*

Sr no	COURSE CONTENT / SYLLABUS	Lectures
UNIT I	**Electronic Signals and Mathematical Tools for Circuit Analysis** Signals: periodic, non-periodic, Continuous Time (CT) and Discrete Time (DT), special electronic signals (impulse, unit step, sinusoidal, ramp, square wave, staircase) 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, Differential Equations, Integration.	**12**
UNIT II	**Transfer functions and Z transform** Concept of Transient and steady state 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) Concept of transfer function of CT and DT systems, Laplace transformation of electrical circuits, two port network functions, time and frequency domain response Stability analysis of electronic circuits using Routh Hurwitz Criterion and using pole zero analysis Z-Transform (ZT): definition, inverse ZT (partial fraction and residue method), ZT of standard electronic signals, properties.	**13**
UNIT III	**Mathematical Equations using C** Laplace transform and Inverse LT of equations using C, Z-Transform equation using C.	**5**
	1. Network Analysis, G. K. Mittal, Khanna Publication. 2. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan and S. Pilli, TMH. 3. Digital Signal Processing, S. Salivahan, A. Vallavraj and C. Gnanpriya, McGraw Hill.	

References:	4. Network Analysis, M. E. Van Valkenberg, PHI. 5. Network and Systems, Roy Choudhary, Wiley Eastern. 6. Computer programming in C, V. Rajaraman, Pearson Education, 2nd edition, 2003. 7. The C programming language, Dennis Ritchie, Pearson Education, 2nd edition, 2003. 8. Object oriented programming in C++, Robert Lafore, Galgotia Publications. 9. Let Us C, Yeshwant Kanetkar, 15th Edition, BPB publication.

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Elective) – II		
YEAR-I	**Name of Paper- Advanced Microcontrollers**	**CREDITS-2**
SEMESTER-I	**Subject Code: PELME-117**	**HOURS-30**

Course specific outcomes-

1. *Understand the architecture of PIC & AVR microcontroller*
2. *To study the instruction set of PIC & AVR microcontroller*
3. *To study the various registers of PIC & AVR Microcontroller*
4. *To study the on-chip peripherals of PIC & AVR microcontroller*

Sr no	COURSE CONTENT / SYLLABUS	Lectures
UNIT I	**PIC Architecture and Assembly Language Programming** Advantages of PIC microcontrollers over MCS-51 series, Overview of the PIC 18 family, Architecture of PIC microcontroller. Registers in the PIC, Introduction to PIC assembly language programming, instruction set and directives, addressing modes, stack, branching and looping, Time delay, instruction pipeline and I/O PORT programming in PIC 18, data serialization.	**15**
UNIT II	**PIC Programming in C** Data types and time delays in C, I/O programming and logic operations in C, Data serialization, RAM and ROM allocation, pin connection and configuration of registers, timer, counter and serial I/O programming., Interrupts programming using PIC microcontrollers, assigning interrupt priority, relay interfacing, stepper motor and DC motor interfacing, I2C protocol and DS1307 interface, SPI protocol and RS485.	**15**
References	1. PIC Microcontrollers and Embedded systems using Assembly and C for PIC18 – M.A. Mazidi, R. D. Mckinlay and D. Causey - Pearson Education, New Delhi- 2009. 2. Embedded design with PIC18F452, John B.Peatman 3. Embedded C programming and the Microchip PIC – Richard Barnet, L.O.Cull and S. Cox Delmer.-2004. 4. Microcontrollers Theory and Application – Ajay V. Deshmukh TMH New Delhi 5. Embedded C Programming and the Atmel AVR, Richard H. Banett, Sarah A. Cox, Larry D. O'Cull,Thomson. 6. Programming and customizing The AVR Microcontroller, Dhananjay Gadre, TMH.	

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major Elective (Practical) – I		
YEAR-I	**Name of Paper- Practical Course –I**	**CREDITS-2**
SEMESTER-I	**Subject Code: PELME-116A**	

List of Practicals:

1. Use of operators in C programming.
2. Use of recursive function.
3. Use of storage classes in C.
4. Accept ‘n’ numbers store them in an array and calculate sum and average.
5. Program to verify maximum power transfer theorem.
6. Arrange the array in ascending and descending order using bubble sort.
7. Reverse a string using library functions.
8. Reverse a string without using library.
9. Write a program to swap two integers using call by value and call by reference method of passing arguments to a function.
10. Write a program to search elements in array.
11. Write a program to perform addition of all elements in array.
12. Write a program to compare two strings using pointers.
13. Write a program to find length of a string using pointers.
14. Write a structure program for student details in C.
15. Write a program to add two distances in feet and inches using structures.

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major Elective (Practical) – II		
YEAR-I	**Name of Paper- Practical Course –II**	**CREDITS-2**
SEMESTER-I	**Subject Code: PELME-117A**	

List of Practicals: (Any 12)

1. Introduction to MPLAB IDE.
2. Simple programs based on simulation in Proteus.
3. Two-digit 7-segment display interfacing with PIC
4. LCD Interfacing with PIC.
5. Bidirectional stepper motor interfacing with PIC.
6. Real Time Clock display on LCD / HyperTerminal (I2C).
7. Use of internal EEPROM of PIC.
8. DAC interfacing (square wave, staircase, triangular, sine) with PIC.
9. Relay interfacing with PIC microcontroller.
10. Ultrasonic sensor interfacing with PIC microcontroller.
11. Use of timers in PIC.
12. Bluetooth interfacing with PIC.
13. On-off controller using PIC.
14. Two-digit frequency counter or event counter interface with PIC.
15. Matrix keyboard / Touch screen interface with PIC.
16. Graphic LCD interfacing with PIC.
17. Zigbee interface with PIC.
18. DC motor control using PWM / Intensity control of LED using PIC.
19. ADC interface with PIC microcontroller
20. UART interface with PIC microcontroller

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Research Methodology		
YEAR-I	**Name of Paper- Research Methodology** **Subject Code: PELRM-118**	**CREDITS-4**
SEMESTER-I		**HOURS-60**

Course specific outcomes-

1. *To know the fundamentals of research*
2. *To know the basics of research analysis*
3. *The present course will help student develop the right concepts about research.*
4. *To have the literature research*
5. *To get the knowledge to write the research proposals*

Sr no	**COURSE CONTENT / SYLLABUS**	**Lectures**
UNIT I	**Foundation of Research:** Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method - understanding the language of research - Concept, Construct, definition, Variable. Research Process **Problem Identification & Formulation:** definition and formulating the research problem, Necessity of defining the problem, Importance of literature review in defining a problem, Research Question - Investigation Question - Measurement Issues - Hypothesis Qualities of a good hypothesis - Null hypothesis & Alternative Hypothesis. Hypothesis **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.	**15**
UNIT II	**Qualitative and Quantitative Research:** Qualitative - Quantitative Research - Concept of measurement, causality, generalization, replication. Merging the two approaches **Data Collection and analysis:** Execution of the research - Observation and Collection of data - Methods of data collection, hypothesis-testing - Generalization and Interpretation. **Measurement:** Concept of measurement - what is measured? Problem in measurement in research - Validity and Reliability. Levels of measurement - Nominal, Ordinal, Interval, Ratio. **Sampling:** Concept of Statistical population, Sample, Sampling Frame, Sampling Error, Sample size, Non-Response. Characteristics of a good sample. Probability Sample -Simple Random Sample,	**15**

	Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample - Practical considerations in sampling and sample size.	
UNIT III	**Data Analysis:** data Preparation - Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis - Cross tabulations and Chi-square test including testing hypothesis of association. **Interpretation of Data and Paper Writing:** Layout of a Research Paper, Journals in Electronics Science, Impact factor of journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of Encyclopaedias, Research Guides, Handbook etc., Academic databases for concerned discipline. **Use of tools / techniques for Research:** methods to search required information effectively, Reference Management Software like Zotero/mendeley, Software for paper formating like LaTeX/MSOffice, software for detection of Plagiarism.	**15**
UNIT IV	**Reporting and Thesis writing:** Structure and components of scientific reports - Types of report - Technical reports and thesis - Significance - Different steps in the preparation - Layout, Structure and Language of typical reports Illustrations and tables - Bibliography, referencing and footnotes - Oral presentation - Planning - Preparation -Practice - Making presentation - Use of visual aids - Importance of effective communication **Application of results and ethics:** Environmental impacts - Ethical issues – ethical committees - Commercialization - Copy right - royalty - Intellectual property rights and patent law - Trade related aspects of intellectual property Rights - Reproduction of published material - Plagiarism - citation and acknowledgement - citation and acknowledgement - Reproducibility and accountability. **Reasoning and Mentalability**: Analogy, Classification, Series, Coding-Decoding, Direction Sense, Representation Through Venn Diagrams, Mathematical Operations, Arithmetical Reasoning, Inserting the Missing Character, Number, Ranking and Time Sequence Test, Eligibility Test**,** Representation through Venn-diagrams, Number & symbols ordering, Comprehension questions, Statement & assumptions, Statement & conclusions, Statement & actions	**15**
References	1)Research Methodology - C. R. Kothari 2)Research Methodology: An Introduction - Stuart Melville and Wayne 3)Practical Research Methods - Catherine Dawson 4)References from the Internet	
Learning outcomes:	*After completion of this course student will be able:* 1. *To introduce to students the concepts of electromagnetics* 2. *To understand the theory of various transmission lines and wave guides* 3. *To apply various parameters of antennas* 4. *To demonstrate various methods of generation of microwaves*	

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Theory) –I		
YEAR-I	**Name of Paper- Applied Electromagnetics, Microwaves and Antennas** **Subject Code: PELMJ-121**	**CREDITS-4**
SEMESTER-II		**HOURS-60**
Course specific outcomes- 1. *To introduce to students the concepts of electromagnetics* 2. *To understand the theory of transmission lines and wave guides* 3. *To study various parameters of antennas* 4. *To study various methods of generation of microwaves*		
Sr no	**COURSE CONTENT / SYLLABUS**	**Lectures**
UNIT I	**Electromagnetic Waves** Review of Maxwell's equations and their meaning, continuity equation, electric and magnetic wave equations in time domain and frequency domain, wave propagation in conducting and non-conducting media, skin depth and high frequency propagation, boundary conditions at the interface between two mediums, Poynting theorem and its applications	**15**
UNIT II	**Transmission Lines** Types of transmission lines, microstrip lines, two wire transmission line, transmission line equations for voltages and currents, inductance and capacitance per unit length of two wire and coaxial cable transmission line, characteristic impedance, propagation constants, attenuation and phase constants, phase velocity, reflection and transmission coefficients, SWR, line impedance, normalized impedance and admittance, Smith chart construction and applications, single stub and double stub matching, applications to reflection of EM-waves at interfaces for normal incidence	**15**
UNIT III	**Waveguides and Components** Concept of waveguides, frequency range, relation to transmission lines Rectangular Waveguides: TM and TE Modes, concept of cut-off frequency, guide impedance, phase velocity, guide wavelength for TE and TM modes, Applications to TE mode in rectangular waveguide, power losses in rectangular waveguide, Circular waveguide (introduction only)	**15**

	Optical Fiber: principles of operation and construction, difference between conducting circular waveguide and fiber Different methods of excitation of TE and TM modes in waveguides Cavity Resonators, Q factor of cavity resonators	
UNIT IV	**Electromagnetic Radiation** Potentials of electromagnetic fields, retarded potential, radiation from oscillating dipole, concept of near zone and radiation zone, radiation resistance, role of antenna in exciting different TE, TM modes in wave guides Antenna Parameters: gain, directivity, power, aperture, Friis equation, radiation pattern Application Areas: antenna temperature, Signal to Noise Ratio (SNR), remote sensing, RADAR equation Antennas Types: λ/2 antenna, antenna arrays, horn antennas, parabolic dish antennas, End fire antenna – Yagi Uda, patch antenna, microstrip antennas EMI and EMC Generation of Microwaves: principle, physical structure and working of - Gunn effect diodes, magnetron oscillator, reflex Klystron oscillator	**15**
References	1. Microwave Devices and Circuits, Samuel Y. Liao, PHI, 3rd Edition, 2002. 2. Principles of Electromagnetics, N. Sadiku, Oxford University Press. 3. Electromagnetics with Applications, Kraus and Fleiseh, McGraw Hill, 5th Edn, 1999. 4. Electromagnetics, J.D. Kraus, 4th Edn, McGraw Hill, 1992.	
Learning outcomes:	*After completion of this course student will be able:* *1) To introduce to students the concepts of electromagnetics* *2) To understand the theory of various transmission lines and wave guides* *3) To apply various parameters of antennas* *4) To demonstrate various methods of generation of microwaves*	

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Theory) – II		
YEAR-I	**Name of Paper- Foundation of Semiconductor Devices**	**CREDITS-4**
SEMESTER-II	**Subject Code: PELMJ-122**	**HOURS-60**

Course specific outcomes-

1. *To introduce crystal structure with reference to semiconductors*
2. *To introduce quantum and statistical mechanics*
3. *To understand the characteristics of semiconductor devices*
4. *To introduce theory of diode, transistor and FETs*

Sr no	COURSE CONTENT / SYLLABUS	Lectures
UNIT I	**Theory of solids** Crystal structure of solids: Semiconductor materials, types of solids, basics of crystallography, space lattice atomic bonding, unit cell, Miller indices imperfections and impurities in solids, methods for semiconductor crystal growth.	**15**
UNIT II	**Introduction to Quantum and statistical Mechanics** Principles of quantum mechanics, Schrodinger wave equation, and Applications of Schrodinger's wave equation for bound state potential problems. Introduction to quantum theory of solids: Allowed & forbidden energy bands, electrical conduction in solids, extensions to three dimensions, density of states, Statistical mechanics: Statistical laws, Fermi-Dirac probability function, the distribution function and the Fermi energy	**15**
UNIT III	**Physics of semiconductors** Semiconductor in equilibrium: Charge carriers in semiconductors, dopant atoms and energy levels, extrinsic semiconductors, Statistics of donors and acceptors, charge neutrality, position of Fermi energy level. Carrier transport phenomena: charge, effective mass, state & carrier distributions, Carrier drift, carrier diffusion, graded impurity distribution, resistivity, Hall effect. Non-equilibrium excess carriers in semiconductors: Carrier generation and recombination, characteristics of excess carriers, bipolar transport, quasi-Fermi energy levels, excess carrier lifetime, surface effects	**15**
UNIT IV	**Basics of Semiconductor Devices** Diode: Junction terminologies, Poisson's equation, built-in potential, depletion approximation, diode equation, Qualitative	**15**

	and Quantitative analysis, Reverse-bias breakdown, avalanching, zener process, C-V characteristics, Transient response. BJT: Terminology, electrostatics and performance parameters, Eber-Moll model, Two port model, hybrid – pi model, device models in spice, Modern BJT structures –polysilicon emitter BJT, Heterojunction bipolar transistor (HBT) FETs: JFET and MESFET - Junction terminologies, characteristics, ac response, spice models MOSFETs: Fundamentals, Capacitance- voltage characteristics, I-V characteristics, Qualitative Theory of Operation, ID - VD Relationship, ac response, spice models.	
References	1. Semiconductor Physics and Devices Basic Principles, Donald A. Neamen, TMH, 3rd Edition (2003) 2. Semiconductor Device fundamentals, Robert F. Pierret, Pearson Education 3. Solid State Electronics Devices, Streetman, PHI, 5th Edition, (2006)	

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Theory) Subject-III		
YEAR-I	**Name of Paper- VLSI System Design**	**CREDITS-2**
SEMESTER-II	**Subject Code: PELMJ-123**	**HOURS-30**

Course specific outcomes-

1. *To study MOS transistor, its characteristics, MOS models.*
2. *To study the various MOS technologies used for VLSI.*
3. *To learn VLSI design and layout design rule.*
4. *To design simple combinational and sequential digital logic circuits.*

Sr. No.	**COURSE CONTENT / SYLLABUS**	**Lectures**
UNIT I	**Basic Electrical Properties of MOS and CMOS Circuits:** MOS transistor – threshold voltage, threshold voltage equations, MOS device equations, basic DC equations, second order effects MOS Models, small signal AC characteristics, NMOS inverter, depletion mode and enhancement mode pull ups, CMOS inverter–DC Characteristics, inverter delay, pass transistor, transmission gate, power consumption in CMOS gates, static dissipation, dynamic dissipation	**10**
UNIT II	**Layout Design Rules:** Need for design rules, Mead Conway design rules for the silicon gate NMOS process, CMOS based design rules, simple layout examples, sheet resistance, area capacitance, wiring capacitance, driving large capacitive loads	**8**
UNIT III	**Digital Logic Design:** Switch logic, pass transistor and transmission gate based design, gate logic, inverter, two input NAND gate–NOR gate, other forms of CMOS logic, clocked CMOS, Logic, recharged Domino CMOS Logic, Structured design Simple combinational logic design examples: parity generator, multiplexers, Clocked sequential circuits: two phase clocking, charge storage, dynamic shift register semi static register, JK flip flop circuit.	**12**
References:	1. Kamran Eshraghian, Douglas A Puknel and Sholeh Eshraghian, "Essentials of VLSI. 2. "Circuits and Systems," prentice Hall of India, New Delhi, 2005. 3. Neil H.E West and Kamran Eshranghian, "Principles of CMOS VLSI Design: A system perspective ", Addison-Wesley, 2nd Edition, 2004. 4. Sung-Mo Kang and Yusuf Leblebici," CMOS Digital integrated circuits", Tata McGraw Hill 3rd Edition, New	

	Delhi, 2008. 5. Jan M Rabaey, Chandrasekaran A and Nikolic B, "Digital Integrated Circuits," Pearson Education, 3rd edition, 2004. 6. Amar Mukharjee, "Introduction to NMOS and CMOS VLSI System," Prentice Hall, USA, 1986. 7. Wayne wolf," Modern VLSI Design : System on chip design", Pearson Education Inc., 3rd Edition, Indian Reprint, 2007. 8. Allen Holberg, "Analog CMOS Design", Oxford University Press. 9. Randall L. Geiger, Phillip E. Allen "VLSI Design techniques for Analog and Digital Circuits" McGraw Hill International Editions.	

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Practical) – III		
YEAR-I	**Name of Paper- Practical Course –III**	**CREDITS-2**
SEMESTER-II	**Subject Code: PELMJ-124**	

List of Practicals: (Any 12)

A. Practicals on Electromagnetics (C / MATLAB):

1. To plot Equipotential contours and field lines for given charge distribution.
2. Use of Smith chart for transmission line pattern and verify using C.
3. Use of MATLAB for potential distribution in a region bound by two conductors.
4. Use of MATLAB for directivity pattern for simple antennas.

B. Practicals based on VLSI:

1. CMOS Inverter.
2. CMOS NAND, NOR.
3. 2:1 MUX by conventional method and by transmission gates.
4. CMOS combinational logic for minimum 4 variables.
5. RS latch, D latch.
6. Edge triggered D register.
7. Clock divider.
8. Synchronous Counter / Shift register.
9. Write VHDL code for full-adder and simulate the waveforms and practically verification using the circuit.
10. Write VHDL code for 8:1 Multiplexer/1:8 de-Mux and simulate the waveforms and practically verification using the circuit.
11. Write VHDL code for a 3-bit binary counter and simulate the waveforms and practically verification using a circuit.
12. Write VHDL code for feedback counter and simulate the waveforms and practically verification using the circuit.
13. Write the VHDL code for RAM and simulate the waveforms.

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Practical) – IV		
YEAR-I	**Name of Paper- Practical Course –IV**	**CREDITS-2**
SEMESTER-II	**Subject Code: PELMJ-125**	

List of Practicals: (Any 12)

1. Evaluation of drift – diffusion equation by using C/MATLAB.
2. Determination & visualization of Fermi level by using C/MATLAB.
3. Characterization of semiconductor material (temperature dependent conductivity) by using C/MATLAB.
4. Determination of diffusion coefficient and plotting of excess carrier distribution by using C/MATLAB.
5. Determination of electron/hole mobility of semiconductor material using Hall effect by using C/MATLAB.
6. Determination of terminal currents in BJT by solving differential equation in base region by using C/MATLAB.
7. Optical conductivity Vs lambda by using C/MATLAB.
8. Solution of partial differential equation by using C/MATLAB.
9. Design of an electromagnetic lift.
10. To determine crosstalk parameters of microstrip lines.
11. Study of waveguide component for directional couplers, H-T plane inverters, power reflectors.
12. Measurement of primary secondary coupling factor in case of transformer with spacing and adjustable core.
13. Study of Antenna parameters.
14. Design of Yagi uda Antenna.
15. Study of parallel strip structure supported by an insulated plane for

    a) characteristic impedance b) frequency response

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Elective) – I		
YEAR-I	**Name of Paper- Device Fabrication Techniques** **Subject Code: PELME-126**	**CREDITS-2**
SEMESTER-II		**HOURS-30**

Course specific outcomes-

Students are expected to:

1. *Have a working knowledge of all the main process areas in a FAB, including Photolithography; Diffusion; Etch, & etc.*
2. *Have knowledge of the key process capital equipment in each area.*
3. *Know about the advent of electronics manufacturing at the nanoscale and the advantages and implications encountered.*
4. *Students should know how to operate, process all of the equipment and function successfully as a team in order to complete the lab objectives.*

Sr. No.	**COURSE CONTENT / SYLLABUS**	**Lectures**
UNIT I	**Environment and Crystal Growth for VLSI Technology:** **Crystal Growth:** Use of silicon as a semiconductor, CZ Techniques for Growing Single-Crystal Silicon, Wafers, ingot formation. **Diffusion:** Nature of diffusion, **Epitaxy:** Molecular Beam Epitaxy, Vapor Phase Epitaxy, Doping and auto-doping, Liquid Phase Epitaxy, **Ion Implantation:** Ion implantation systems, implantation damage and annealing, **Deposition:** Evaporation, Sputtering and Chemical Vapor Deposition (CVD, PECVD, APECVD, ALD), **Etching:** Wet chemical etching, dry physical etching, dry chemical etching.	**12**
UNIT II	**Lithography:** What is photoresist? Positive and negative resists, Photomask and its preparation. **Optical lithography:** basic steps of photolithography, Electron beam lithography (EBL), EUV lithography, X-ray lithography. **Oxidation:** Thermal oxidation process of silicon, Properties of Silicon Dioxide, **Thermal Oxidation:** Dry, Wet, Oxidation furnaces, high and low-pressure oxidations.	**10**
UNIT III	**Characterization Techniques:** **Physical Characterizations:** XRD, SEM, TEM, Elliposometry, AFM, **Chemical Characterizations:** Spectroscopic Techniques U-V, FTIR, EDXS. **Electrical Characterization**: I-V, C-V measurement, Hall probe technique, resistivity measurement, Four probe techniques.	**8**

References:	1. Solid State Electronic Devices, Streetman and Banerjee, PHI, 6th Edition. 2. VLSI technology, S, M. Sze, Mc Graw Hill Int. Book Co. 3. Integrated Circuit Engineering, B. Glasser and S. Sharpe 4. The Science and Engineering of Microelectronic Fabrication by Stephen A. Campbell (Oxford University Press) 5. Semiconductor Manufacturing and Process Control by Gary S. May and Costas J. Spanos (IEEE, Wiley-Inter-science) 6. Semiconductor Integrated Circuit fabrication techniques: P. E. Gise and R. Blanchard 7. Silicon Processing for the VLSI Era(Volume 1- Process Technology, Volume 2 – Process Integration and Volume 3 – The Submicron MOSFET) by S. Wolf and R. N. Tauber, Lattice Press, Sunset Beach, California 8. Integrated Circuit Manufacturability – The Art of Process and Design Integration, edited by Jose Pineda de Gyvez and Dhiraj K. Pradhan (IEEE Press)

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major (Elective) – II		
YEAR-I	**Name of Paper- 32-bit Microcontroller based System Design** **Subject Code: PELME-127**	**CREDITS-2**
SEMESTER-II		**HOURS-30**

Course specific outcomes-

1. *Understand the architecture of ARM microcontroller*
2. *To study the instruction set of ARM*
3. *To study the various registers of ARM Microcontroller*
4. *To study the on-chip peripherals of ARM microcontroller*

Sr no	**COURSE CONTENT / SYLLABUS**	**Lectures**
UNIT I	**Fundamentals of ARM Microcontrollers:** Introduction to ARM microcontroller, ARM Core Philosophy, Bus Architecture, AMBA Bus, AHB, APB, Registers: Current program status register (CPSR), Saved program status register (SPSR), Stack pointer, Link register, Modes of processor, States of the processor, ISA, Pipelining register, Current program status register (CPSR), Saved program status register (SPSR), TDMI, Interrupts and Exceptions, Interrupt latencies. Nomenclature of ARM families.	**12**
UNIT II	**Architecture of LPC 2148** Block diagram, Pin Description, On-Chip memory, memory map, GPIO, clock and timing, power control modes**.** **On chip peripherals:** On chip peripherals, Programming with ADC, DAC, DMA controller, UART, Timer/Counter, Real time clock, Watchdog timer, PWM, CAN and Ethernet, I2C mode, USB, host/slave.	**8**
UNIT III	**ARM based embedded system development:** ARM based embedded system design, clock circuit, reset circuit, power supply, Examples in embedded C programming. Interfacing of LED, Relay, Optocouplers etc. Development of Embedded system for temperature, humidity, pH , displacement etc. Operating systems principles, embedded operating systems, Introduction to Boot loaders and Board Support Packages.	**10**

References:	1. ARM System Developers Guide- A. N. Sloss, D. Symes & C. Wright – Elsevier (2004) 2. ARM System on Chip Architecture- Steve, Furber Pearson Education, 2013 3. Product data sheet of LPC 2148.
Learning outcomes:	*After completion of this course student will be able:* 1. *To understand the internal architecture of ARM microcontroller* 2. *To use instructions to write the programs* 3. *To study the on chip peripherals of ARM LPC 2148* 4. *To develop the systems based on ARM LPC 2148 microcontroller*

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major Elective (Practical) – I		
YEAR-I	**Name of Paper- Practical Course –I**	**CREDITS-2**
SEMESTER-II	**Subject Code: PELME-126A**	

List of Practicals: (Any 12)

1. Study of wafer handling and cleaning.
2. Growth of Silicon dioxide layer for nanoelectronics applications.
3. Study of chemical deposition techniques.
4. Study of physical deposition techniques.
5. Study of Photolithography using photoresist.
6. Studies on dry and wet etching processes for semiconductor thin films.
7. Studies on optical characterization techniques ellipsometry.
8. Studies on optical characterization techniques FTIR.
9. Studies on chemical characterization techniques SEM and EDAX.
10. Studies on physical characterization techniques XRD.
11. Studies on morphological characterization techniques AFM.
12. I-V characteristics of BJT devices.
13. I-V characteristics of MOSFET devices.

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
Major Elective (Practical) – II		
YEAR-I	**Name of Paper- Practical Course –II**	**CREDITS-2**
SEMESTER-II	**Subject Code: PELME-127A**	

List of Practical's: (Any 12)

1. Two-digit 7-segment display interfacing
2. LCD interfacing
3. Bidirectional stepper motor interfacing.
4. Real Time Clock display on LCD.
5. Introduction to the Linux commands.
6. DAC interfacing (square wave, staircase, triangular, sine)
7. ADC interface with ARM.
8. On-off controller.
9. Two-digit frequency counter or event counter using timer / interrupt.
10. Matrix keyboard / Touch screen.
11. Graphic LCD interfacing.
12. Zigbee communication.
13. DC motor control using PWM / intensity control of LED
14. Bluetooth interfacing with ARM.
15. UART interface with ARM.
16. Processing inputs on Linux.

	MODERN EDUCATION SOCIETIES **NOWROSJEE WADIA COLLEGE, PUNE**	**Academic Year** **2024-2025**
Master of Electronic Science		
OJT		
YEAR-I	**Name of Paper- Practical Course –II**	**CREDITS-4**
SEMESTER-II	**Subject Code: PELOJT-128**	

On Job Training

EVALUATION PATTERN: For Two Credit Courses

(i) Each course shall be evaluated with Continuous Evaluation (CE) and End Semester Examination (EE).

(ii) Continuous Evaluation shall be of 15 marks and End Semester Examination (EE) shall be of 35 marks

(iii) To pass a course of 2credits, a student has to earn minimum 20 marks, provided that he/she should earn minimum 6 marks in Continuous Evaluation and minimum 14 marks in End-Semester Examination. That is passing criterion is minimum 40% marks in the examination.

(iv) For Internal evaluation (out of 15 marks), There has to be one written test of 10 marks (Mid-Semester Examination). For remaining 5 marks shall be based on the continuous evaluation consisting of tutorial, viva, seminars, home-assignments, mini project, survey, group discussion etc.(on approval of Head of the Department)

(v) There shall be revaluation of the answer scripts of End-Semester Examination (out of 35 marks) of theory papers only, but not of internal assessment papers as per Ordinance No. **134 A and B.**

ATKT RULES: As per SPPU.

AWARD OF GRADES AND GRADE POINTS

The mapping of percentage to letter grade and grade point is given in the following Table 1

CGPA will be calculated as follows:

Table No. 1

Sr. No.	Grade Letter	Grade Point	Marks
1.	O (Outstanding)	10	90 □ Marks □ 100
2.	A+ (Excellent	9	80□ Marks □ 89
3.	A (Very Good)	8	70 □ Marks □ 79
4.	B+ (Good)	7	55 □ Marks □ 69
5.	B (Above Average)	6	50 □ Marks □ 54
6.	C (Average)	5	45 □ Marks □ 49
7.	D (Pass)	4	40 □ Marks □ 44
8.	F (Fail)	0	Marks □ 40
9.	Ab (Absent)	0	

PERFORMANCE INDICES:

The performance of a student in a Semester is indicated by a number called the Semester Grade Point Average (SGPA). Similarly, the performance of a student in the Course is indicated by a number called the Course Grade Point Average (CGPA).

The End-Semester results and final result of the courses will contain SGPA and CGPA, respectively.

(1) **SGPA**: The SGPA is the weighted average of the grade points obtained by students in all the courses during the Semester. That is

$$SGPA = \frac{\sum_{i=1}^{p} C_i G_i}{\sum_{i=1}^{p} C_i}$$

(2) For example, suppose in a Semester, student has registered for five courses having credits C1, C2, C3, C4 and C5 and suppose his/her grade points are G1, G2, G3, G4 and G5, respectively. The SGPA is calculated as

$$SGPA = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

SGPA is calculated correct up to two decimal places by rounding off.

(3) **CGPA**: The CGPA is the weighted average of the grade points obtained in all courses (theory and Practicals) by students in all the courses in 6 semesters. It is calculated in the same manner as the SGPA.

RESULTS:

Based on the performance of the student in the Semester Examinations, Nowrosjee Wadia College will declare the results and issue the Semester Grade sheets. Also, the College will declare the results and issue the Grade sheets at the end of the course.

The class will be awarded to a student on the basis of CGPA. The award of the class shall be as per Table 2 and corresponding percentage calculation for the CGPA is given in Table No. 3

Table 2

Sr. No.	CGPA	Class of the degree awarded
1	9.50 or more than 9.50	OUTSTANDING (O)
2	8.50 or more but less than 9.50	EXCELLENT (A+)
3	7.50 or more but less than 8.50	VERY GOOD (A)
4	6.25 or more but less than 7.50	GOOD (B+)
5	5.25 or more but less than 6.25	ABOVE AVERAGE (B)

6	4.75 or more but less than 5.25	AVERAGE (C)
7	4.00 or more but less than 4.75	PASS (D)

Percentage of marks corresponding to CGPA is calculated by the formulae which are given in the following Table 3.

Table 3

GRADE	Formula for the percentage of marks
O	20 × CGPA - 100
A+	10 × CGPA -5
A	10 × CGPA - 5
B+	12× CGPA - 20
B	5× CGPA + 23.75
C	10 × CGPA -2.50
D	6.6× CGPA + 13.6

The above percentage calculations are illustrated in the following Table 4

Table 4

Some examples of CGPA to Percentage calculations

CGPA obtained	Formula	Percentage (%)	Grade
10	20 × 10 - 100 = 100	100	O
9.75	20 × 9.75 - 100 = 95	95	O
9.5	20 × 9.5 - 100 = 90	90	O
9.0	10 × 9 – 5 = 85	85	A+
8.0	10 × 8.0 – 5 = 75	75	A
7.0	12 × 7.0 – 20 = 64	64	B+
6.67	12 × 6.67 – 20 = 60.04	60.04	B+
6.25	12× 6.25 – 20 = 55	55	B+
5.25	5 × 5.25 + 23.75 = 50	50	B
4.75	10 × 4.75 – 2.50 = 45	45	C
4.0	6.6 × 4.0 + 13.6 = 40	40	D

While declaring the results, the existing ordinances are applicable. There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course.

PATTERN OF THE QUESTION PAPER: EVALUATION PATTERN: For Four Credit Courses

(i) Each course shall be evaluated with Continuous Evaluation (CE) and End Semester Examination (EE).

(ii) Continuous Evaluation shall be of 30 marks and End Semester Examination (EE) shall be of 70 marks.

(iii) To pass a course of 4 credits, a student has to earn minimum 40 marks, provided that he/she should earn minimum 12 marks in Continuous Evaluation and minimum 28 marks in End-Semester Examination. That is passing criterion is minimum 40% marks in the examination.

(iv) For Internal evaluation (out of 30 marks), There has to be one written test of 20 marks (Mid-Semester Examination). For remaining 10 marks shall be based on the continuous evaluation consisting of tutorial, viva, seminars, home-assignments, mini project, survey, group discussion etc. (on approval of Head of the Department)

(v) There shall be revaluation of the answer scripts of End-Semester Examination (out of 70 marks) of theory papers only, but not of internal assessment papers as per Ordinance No. **134 A and B.**

PATTERN OF THE QUESTION PAPER: Four Credits

(1) Internal Examination:

(Mid-Semester Examination of 20 marks, Duration: 30 Mins)

Question No.	Total Marks	No. Of questions	Remarks
Q. 1.	10	Attempt any 5 out of 7	Definitions/Counter examples/Short answer / objective type of questions/True or False. (Each question carries 2 mark.)
Q. 2.	10	Solve any 1 out of 2 questions	Descriptive type questions (Each question carries 10 marks)

(2) End Semester Examination (EE):

Shall be of 70 marks, 2 hours and 30 Minutes duration. The pattern of the question paper shall be as follows:

Question No.	Total Marks	No. Of questions	Remarks
Q. 1.	10	Solve any 5 out of 7	Definitions/Counter examples/Short answer / objective type of questions/True or False. (Each question carries 2 mark.)
Q. 2.	20	Solve any 5 out of 7 OR Solve any 2 out of 3	Descriptive type questions
Q. 3.	20	Solve any 2 out of 3	Descriptive type questions (Each question carries 5 marks)
Q. 4.	20	Solve any 2 out of 3 OR Solve any 1 out of 2	Descriptive type questions

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