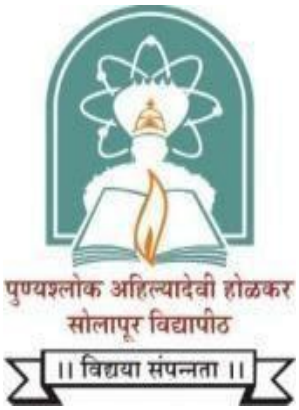
Punyashlok Ahilyadevi Holkar Solapur University, Solapur



NAAC Accredited-2022
'B^{++}'Grade (CGPA2.96)

Name of the Faculty: Science &Technology

(As per New Education Policy 2020)

Syllabus: Electronic Science

Name of the Course: M.Sc. II (Sem. III & IV)

(Syllabus to be implemented from June 2024)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
Nep 2020 Compliant Curriculum
MSc (Electronic Science)
Program Preamble

The Master of Science (MSc) in Electronic Science is a comprehensive and dynamic program designed to provide students with a deep understanding of the fundamental principles of Entrepreneurship, along with the practical skills required to apply this knowledge in various scientific and technological contexts. Aligned with the vision of the National Education Policy (NEP) 2020, the program offers a flexible, multidisciplinary, and learner-centric curriculum that encourages critical thinking, innovation, and holistic development. The MSc Electronic Science program spans two years, with each year offering a progressively advanced curriculum designed to build a strong foundation in Electronic Science while allowing for specialization and interdisciplinary learning. The curriculum is structured around several key components:

1. **Discipline Specific Core Courses:** These core courses form the backbone of the program, providing in-depth knowledge and understanding of essential Electronic Science concepts, theories, and methodologies. Students will engage with topics from Internet of Things, Advance Embedded System, Advance Embedded System, PLC and SCADA, Integrated Circuits and VLSI etc. ensuring a robust and comprehensive education in the multidisciplinary approach.

2. **Discipline Specific Elective Courses:** The program encourages intellectual exploration beyond the core discipline by offering a wide range of elective courses. These electives enable students to pursue their interests in diverse subjects, fostering creativity, critical thinking, and a well-rounded educational experience.

3. **Field Projects /Internships /Apprenticeships /Community Engagement Projects /On-Job Training:** To bridge the gap between theoretical knowledge and real-world applications, the program includes opportunities for field projects, internships, apprenticeships, and community engagement. These experiences provide students with practical insights, problem-solving abilities, and exposure to professional environments, enhancing their readiness for careers in Electronic Science and related fields.

4. **Research Methodology and Research Projects:** Research is a critical component of the MSc Electronic Science program, with students acquiring skills in research methodology, data collection, analysis, and scientific inquiry. By engaging in independent research projects, students are encouraged to develop innovative solutions to complex scientific problems, preparing them for advanced studies and research-oriented careers.

Multiple Entry and Multiple Exit Options

In accordance with the NEP 2020, the MSc Pharmaceutical Chemistry program incorporates a Multiple Entry and Multiple Exit framework, offering students the flexibility to enter or exit the program at various stages. This approach ensures that students can tailor their educational journey according to their personal and professional goals, with options to earn certificates, diplomas, or degrees based on the duration of study completed.

- **Year 1**
  Upon completion of the first year, students may exit with a **Diploma in Electronic Science**

- **Year 2**
  Upon Completion of the two-year, student may exit with a **MSc Degree in Electronic Science .**

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
Nep 2020 Compliant Curriculum

MSc (Electronics Science)
Program Outcomes (PO)

Students Post graduating from the Master of Science in Electronic Science program will be able to:

Major Courses:

- **PO1**: Demonstrate in-depth knowledge and understanding of core concepts, theories, and methodologies in the chosen major discipline.
- **PO2**: Apply disciplinary knowledge to solve complex problems, analyze data, and make informed decisions in professional and research contexts.

Electives Courses:

- **PO3**: Explore diverse subjects beyond the core discipline, fostering a broad-based education and cultivating critical thinking and creativity.

Field Projects/Internship/Apprenticeship/Community Engagement Projects/ On Job Training/ Internship/Apprenticeship:

- **PO4**: Apply theoretical knowledge to real-world situations through field projects, internships, community engagement and On job Training for gaining practical experience and problem-solving skills.

Research Methodology and Research Project:

- **PO5**: Acquire research skills, including data collection, analysis, and interpretation, fostering a scientific approach to problem-solving to develop independent research projects handling capabilities.
- **PO6:** To develop the ability to present Electronic Science research by means of an oral presentation, a scientific poster or a written report.

General Structure of the Course:

Level/ Difficulty	Sem.	Paper Code	Title of the Paper	Semester exam			L	T	P	Credits
			Mandatory	**Theory**	**IA**	**Total**				
		DSC-5 2320301	Internet of Things	60	40	100	4	--	-	4
		DSC-6 2320302	Advance Embedded System	60	40	100	4		-	4
			Elective (Anyone)							
	III	**DSE-3 A** 2320306	Optical Fiber Communication	60	40	100	4		-	4
		DSE-3 B 2320307	Microwave Devices and Applications	60	40	100	4		-	
		DSE-3 C 2320308	Introduction to Electronics Materials	60	40	100	4		-	
6.5/400			**Field Project/RP/Internship/Apprenticeship/**							
		RP 2320303	Research Project	60	40	100	4	-	0	4
			Practical							
		DSC-5 P 2320304	Internet of Things	30	20	50	-	-	2	6
		DSC-6 P 2320305	Advance Embedded System	30	20	50	-	-	2	
			Elective (Any one)							
		DSE-3A P 2320309	Optical Fiber Communication	30	20	50			2	
		DSE-3B P 2320310	Microwave Devices and Applications	30	20	50			2	
		DSE-3C P 2320311	Introduction to Electronics Materials	30	20	50			2	
			Total for III semester	**330**	**220**	**550**	**16**	**550**	**6**	**22**
			Mandatory							
		DSC-7 2320401	PLC and SCADA	60	40	100	4		-	4
		DSC-8 2320402	Integrated Circuits and VLSI	60	40	100	4	--	-	4
	IV		**Elective (Any one)**							
		DSE-4A 2320405	Python and Machine Learning	60	40	100	4		-	4

		DSE-4B 2320406	Biomedical Electronic Instrumentation	60	40	100	4		-	
		DSE-4C 2320407	Modern Communication System	60	40	100	4		-	
			Field Project/RP/Internship/Apprenticeship/							
		RP 2320403	Research Project	90	60	150	6	-	0	6
			Practical							
		DSC-7 P 2320404	Practical-I	30	20	50	-	-	2	4
			Elective (Any one)							
		DSE-4A P 2320408	Practical-II (Based on DSE-4A)	30	20	50			2	
		DSE-4B P 2320409	Practical-II (Based on DSE-4B)	30	20	50			2	
		DSE-4B P 2320410	Practical-II (Based on DSE-4C)	30	20	50			2	
			Total for II semester	**330**	**220**	**550**	**18**	**550**	**4**	**22**

DSC- Discipline Specific Course, DSE- Discipline Elective course
RM- Research Methodology, OJT- On Job Training
RP – Research Project
L – Lecture, T – Tutorial, P – Practical Credits of Theory = 4 Hours of teaching per week
2 Credits of Theory = 4 Hours per week

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
Nep 2020 Compliant Curriculum

MSc (Electronics Science)
Program Specific Outcomes (PSOs)

Students post graduating from the Master of Science in Electronics Science will able to:

- **PSO 1:** Understand the basics of different subjects in Electronics Science
- **PSO 2:** Display the knowledge of appropriate theory, practices and tools for the specification,design, implementation
- **PSO 3** Ability to formulate, model, design solutions, procedures and use software tools to solve real-world problems and evaluate.
- **PSO 4:** Develop the ability to present Electronics Science research by means of an oral presentation, a scientific poster or a written report.

Semester – III

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-III** **Vertical: DSC** **Course Code: 2320301** **Course Name: Internet of Things**
***Teaching Scheme** **Lectures: 04 Hours/week, 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: The Internet of Things (IoT) represents a transformative shift in the way we interact with technology, enabling seamless connectivity between devices, systems, and people. As everyday objects become "smart" through embedded sensors, software, and internet connectivity, IoT is revolutionizing industries—from healthcare and agriculture to smart cities and manufacturing—enhancing efficiency, productivity, and innovation. This course will explore the fundamental concepts, technologies, and applications of IoT. It will provide a comprehensive understanding of the IoT ecosystem, including key components like sensors, communication protocols, data analytics, and cloud computing. Students will learn how IoT systems are designed, deployed, and secured, and will gain hands-on experience in building and managing IoT projects. By the end of the course, participants will be equipped with the knowledge and skills necessary to harness the power of IoT in various domains, driving technological advancement and fostering a deeper connection between the physical and digital worlds.

	Course Objectives:
•	To know the applications of IoT
•	To understand the different types IoT Protocols
•	To get skill for the confirmation of single board computer
•	To get knowledge of cloud computing
	Course Outcomes:
CO1:	The student is able to apply IoT Applications.
CO2:	The student can learn IoT theory.
CO3:	The student can adopt the skill to learn IoT
CO4:	The student is able to know how cloud is more important in IoT
Unit 1:	**Introduction to IoT** **[15]** **Weightage: 15M**
	IoT, origin of terminology, characteristics, market share, evolution of connected devices, modern day IoT applications, IoT enablers(supportive companies), connectivity layers, IoT vs. M2M, Technology interdependence

Unit 2:	**Basics of IoT Networking** **[15]** **Weightage: 15M**
	Sensing(need, definition, classification, applications), Actuation (need, definition, classification, applications), IoT components, IoT categories, Challenges, Fundamentals of IoT networking(MQTT, CoeP, SmQTT,XmPP), Connectivity technology(CSMA,WSN, bluetooth, Xbee,WiFi, LoWPAN etc.), sensor network terminology and fundamentals. Sensor networks, Sensor node, Applications of WSN, coverage, area coverage, Barrier coverage, UAV features, Key issues, UAV networks, machine to machine communication, interoperability of IoT.
Unit 3:	**Introduction to Single Board computers (Raspberry Pi):** **[15]** **Weightage: 15M**
	Overview of Single Board computers, introduction to Raspberry pi variants, study of raspberry pi 4 and fundamentals of IoT devices and Services. GPIO pins basics, Interfacing LED , Buzzer, DC motor, LCD display, Incorporating python time, Delay function in uSec/mSec/Sec using Library, ADC interfacing to Raspberry pi, serial/USB communication.
Unit 4:	**IoT services and applications** **[15]** **Weightage: 15M**
	Introduction to software defined networks, software defined IoT networking, cloud computing, definition, fundamentals, service model, Service management, Service security, sensor cloud, **IoT services**: Web server, MQTT, Blynk, things speak **Applications using IoT services:** temperature monitoring and control, weather station, smart lift monitoring, Motor control, Smart irrigation and soil monitoring, Gas detection and Alert, Heat beat monitoring using IoT services. Introduction to industrial IoT.
	Reference books:
	1. Sudip Mishra, Transcripts of Introduction Internet of things, IIT Kharagpur. 2. Rajkumar buyya, Internet of things, Nov-2014. 3. Jaffrey, Internet of things-IoT European research clusters, 2013. 4. Ronald Y Yager, New advances in Internet of Things, Springer 2018. 5. Raspberry Pi Cookbook, Simon Monk, o'reilly 6. Raspberry Pi User Guide, by Eben Upton and Gareth Halfacree, Wiley 7. Raspberry pi sensors, Rushi Gajjar, packet 8. Raspberrypi.org

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-III** **Vertical: DSC** **Course Code: 2320302** **Course Name: Advance Embedded System**
***Teaching Scheme** **Lectures: 04 Hours/week, 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: Embedded systems are the backbone of modern technology, powering everything from smartphones and automotive control systems to industrial machines and medical devices. As industries demand smarter, faster, and more efficient systems, the design of embedded systems has evolved into a complex, interdisciplinary field that blends hardware, software, and real-time performance. This **Advanced Embedded System Design** course delves deep into the principles and practices needed to develop sophisticated embedded solutions. It builds upon foundational knowledge and focuses on cutting-edge topics such as high-performance microcontrollers, real-time operating systems (RTOS), advanced programming techniques, power optimization, and system-level integration. Students will explore various architectures, peripheral interfaces, and communication protocols essential for designing reliable and scalable embedded systems. By the end of this course, participants will possess the advanced skills required to design, optimize, and troubleshoot complex embedded systems, empowering them to take on the challenges of modern technology development in industries such as automotive, robotics, aerospace, and consumer electronics.

	Course Objectives:
•	Understand Embedded Systems Architecture
•	Design and Implement Embedded Systems
•	Work with Microcontroller Programming
•	Apply Real-Time Operating Systems (RTOS)
	Course Outcomes:
CO1:	Analyze Complex Embedded Architectures
CO2:	Integrate Advanced Peripherals and Interfaces
CO3:	Design Real-Time Embedded Systems
CO4:	Explore Emerging Trends in Embedded Systems
Unit 1:	**Embedded system Introduction** **[15]** **Weightage: 15M**
	Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems, Introduction to

	ARM core architecture, LPC 2148, ARM instruction set, Thumb Instruction set, Memory and memory mapped I/O, Pipeline, Interrupts and Vector table, I/O ports, timers, counters, interrupts, RTC modules, WDT, PLL, PWM, USB etc.
Unit 2:	**Communication protocols** **[15]** **Weightage: 15M**
	UART, SPI, SCI, SSP, I2C, CAN, USB etc. Basic embedded C programs for on-chip peripherals studied in system architecture, Need of interfacing, interfacing techniques, interfacing of different displays and I/O devices
Unit 3:	**Real Time Operating System Concept** **[15]** **Weightage: 15M**
	Architecture of kernel, task scheduler, ISR, Semaphores, mailbox, message queues, pipes, events, timers, memory management, RTOS services in contrast with traditional OS.
Unit 4:	**Case Studies** **[15]** **Weightage: 15M**
	RTOS for control systems, Case study of embedded system like digital camera, Mobile phones, Mobile Internet Device.
	Reference books:
	Text books: 1. Embedded systems: a contemporary design tool, James K. Peckol- Wiley India 2. Embedded systems software primer- David Simon – Pearson 3. ARM System-on-Chip Architecture- Steve Furber - Pearson 4. Jean J Labrose - MicroC / OS-II, Indian Low Price Edition. **Reference Books:** 1. DR.K.V.K.K. Prasad - Embedded / real time system – Dreamtech 2. Iyer, Gupta - Embedded real systems Programming -TMH 3. Steve Heath - Embedded System Design- Neuwans 4. Frank Vahid - Embedded Systems - Wiley India 5. Embedded Systems, Rajkamal -TMH. 6. ARM System Developer's Guide, Designing and Optimizing System Software - Andrew N. Sloss , Dominic Symes, Chris Wright - Morgan Kaufmann Publisher. 7. Datasheet of LPC 2148.

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-III** **Vertical: DSE (3A)** **Course Code: 2320306** **Course Name: Optical Fiber Communication**
***Teaching Scheme** **Lectures: 04 Hours/week, 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: The rapid evolution of communication technologies has transformed the way information is transmitted and received globally. Optical fiber communication lies at the heart of this revolution, providing the backbone for high-speed data transmission with unparalleled efficiency. This course on Optical Fiber Communication is designed to introduce students to the core principles, design considerations, and practical applications of fiber optic systems. The course will explore key topics such as light propagation through optical fibers, types of optical fibers, signal degradation and attenuation, multiplexing techniques, and system design. Students will gain insights into the role of fiber optics in telecommunications, broadband internet, medical imaging, and other cutting-edge fields. By the end of the course, students will develop a comprehensive understanding of how optical fiber communication supports the modern world's demand for faster, more reliable, and high-capacity networks. This knowledge will be crucial for those aiming to contribute to the future of telecommunications and data transmission.

	Course Objectives:
•	To know Analyze Fiber Types.
•	To understand theoretical and practical Components and Devices
•	To analyze the various Design Optical Networks
•	To know about Emerging Trends
	Course Outcomes:
CO1:	The students can able to explain Optical Fiber Fundamentals.
CO2:	The students can get knowledge about Compare Optical Fiber Types
CO3:	The students can able to Utilize Key Components
CO4:	The students can able to tell Integrate Emerging Technologies
Unit 1:	**Introduction** **[15]** **Weightage: 15M**
	Electromagnetic nature of light, Uniform plane waves, The general optical communication system, Total internal reflection, Ray theory of optical fibers, Fibers alignment and joint loss, Fiber splices, connectors, Fiber couplers. Attenuation and dispersion in optical fibers, losses in fibers, Linear and Nonlinear scattering losses, fiber bend loss, Mid-infrared and Far-Infrared transmission. Dispersion: Intermodal and Intramodal dispersion.

Unit 2:	**Optical sources** **[15]** **Weightage: 15M**
	Lasers and LEDs, Concepts of spontaneous and stimulated emission of ligh, semiconductor Lasers, Laser fiber coupling, Non-semiconductor Lasers, Laser Modulation, LED power and efficiency. Detectors – PN, PIN photodiodes, Avalanche photodiodes (APD), Mid-infrared and photoconductive detectors, Phototransistors.
Unit 3:	**Optical fiber Measurements** **[15]** **Weightage: 15M**
	Refractive index profile, cut-off wavelength, Numerical aperture, fiber diameter and field measurements. Receiver performance considerations: Noise, Receiver structures, FET preamplifiers, High performance amplifiers.
Unit 4:	**Digital modulation technique:** **[15]** **Weightage: 15M**
	Sampling theorem, channel capacity, FDM, TDM, FDMA, TDMA, CDMA and OFMDA, Digital modulation technique: PCM, ASK, FSK, PSK, BPSK, QPSK and QAM. 4^{th} generation and 5^{th} generation mobile communication, Basics of cellular communication (GSM, CDMA)-Cell architecture, Base stations, relay stations and principles of communication, Introduction to Bluetooth, Wi-Fi, Wi-Max and LTE network.
	Reference books:
	1. Digital and Data Communications – Martin (PHI) 2. Hand Book of Electronic Communications – Miller 3. Optical Fiber Communication - Senior

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-III** **Vertical: DSE (3B)** **Course Code: 2320307** **Course Name: Microwave Devices and Applications**

***Teaching Scheme** **Lectures: 04 Hours/week, 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: Microwave technology plays a pivotal role in modern communication, radar systems, medical devices, and various industrial applications. As the demand for faster, more reliable, and efficient wireless communication systems continues to grow, understanding microwave devices and their applications becomes increasingly critical for engineers and researchers. This course on Microwave Devices and Applications is designed to introduce students to the fundamental principles of microwave engineering, along with the design, analysis, and practical implementation of microwave devices. The course covers a wide range of topics, including wave propagation, transmission lines, microwave resonators, amplifiers, oscillators, and antennas. It will also delve into the design and application of microwave circuits and systems in industries such as telecommunications, aerospace, defense, and healthcare. Throughout the course, students will develop the technical skills and analytical tools required to understand and work with microwave components and systems. This knowledge will be essential for those pursuing careers in fields such as telecommunications, satellite communication, radar technology, and medical imaging.

	Course Objectives:
•	To know the basic concepts of Understanding of Microwave Theory
•	To understand the classification and structures Microwave Devices
•	To get knowledge about Applications
•	To know the Awareness of Emerging Technologies
	Course Outcomes:
CO1:	The student knows the Understanding of Microwave Theory.
CO2:	The student is able to understand the Knowledge of Microwave Devices.
CO3:	The student is able to understand the Application of Microwave Technology.
CO4:	Able to know the Design and Implementation of Microwave Systems.
Unit 1:	**Introduction :** **[15]** **Weightage: 15M**
	Maxwell's equations, correspondence of field and circuit equations, characteristic impedance and admittance, Transmission lines, standing wave and standing wave ratio, Waveguides: propagation modes, types of waveguides, waveguide components- E and H plane T, Magic 'T' microwave couplers, matched terminations, directional couplers, circulators and isolators, Phase shifters, cables, connectors

Unit 2:	**Physical Structure** **[15]** **Weightage: 15M**
	Physical Structures, Configurations, Principles of operation and applications of : Tunnel diode, Gunn Diode, IMPATT and TRAPATT Diode, Parametric Amplifiers, Microwave Transistors, HBTs, Microwave JFETs, MESFETs, HEMTs, MOSFETs, Ridley – Watkins-Hilsum theory, LSA, INP and CdTe diode.
Unit 3:	**Microwave Tubes and Circuits:** **[15]** **Weightage: 15M**
	Limitation of conventional solid state devices at Microwave frequency, Microwave Tubes and Circuits: Klystrons, TWT, Magnetron Oscillators – Cylindrical Magnetron, Linear Magnetron, Coaxial Magnetron, Voltage-Tunable Magnetron.
Unit 4:	**Antennas:** **[15]** **Weightage: 15M**
	Antennas: Types of antennas: Short dipole antennas, antenna arrays, isotropic, dipole, broadside and end fire arrays, Yagi-Uda, log periodic and rhombic antenna, Reflector antennas, Reconfigurable antennas, Phased array antennas, Cognitive radio, Microstrip Antennas. Antenna parameters: S parameter, VSWR, Gain, Radiation resistance, Radiation pattern, beam width, bandwidth, efficiency, Polarization.
	Reference books:
	1. 1. Liao Samuel Y, *Microwave Devices and Circuits*, Prentice-Hall of India Private Limited, New Delhi 2001 2. Pozar David M., *Microwave Engineering*, John Wiley and Sons, Inc. New York 1999. 3. Microwave Devices and Circuits, Samuel Y. Liao, PHI, 3rd Edition. 4. Microwave Engineering, David M.Pozar, Wiley India, 3rd Edition. 5. Microwave Principles-Herbert J.Reich, J.G.Skalnik, P.F.Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi, 2004. 6. Microwave Engineering Passive Circuits-Peter A.Rizzi, PHI, 1999. **7.** Electronic and Radio Engineering-F.ETerman, McGraw-Hill, 4th ed., 1955

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-III** **Vertical: DSE (3C)** **Course Code: 2320308** **Course Name: Introduction to Electronics Materials**

***Teaching Scheme**	***Examination Scheme**
Lectures: 04 Hours/week, 04 Credits	**UA: 60 Marks** **CA: 40 Marks**

Course Preamble: The Introduction to Electronic Materials course provides a foundational understanding of the materials used in modern electronic and optoelectronic devices. The rapid advancement of technologies such as semiconductors, sensors, integrated circuits, and energy storage devices relies on a deep knowledge of the underlying materials that enable their functionality. This course aims to explore the properties, behavior, and fabrication processes of electronic materials, focusing on semiconductors, dielectrics, conductors, magnetic materials, and optical materials. Through this course, students will gain insights into the electronic, thermal, optical, and mechanical properties of materials and understand how these properties impact device performance. The course is designed to bridge the gap between materials science and electronics engineering, equipping students with the tools necessary to design, analyze, and innovate in the field of electronics. By the end of the course, students will have a comprehensive understanding of material selection, processing techniques, and the role of electronic materials in various applications such as transistors, LEDs, solar cells, sensors, and more.

	Course Objectives:
•	To know the basic Understanding Material Properties for Electronics.
•	Explore Semiconductors and Their Role
•	To get knowledge about Device Applications of Materials
•	To know the Awareness of Emerging Technologies
	Course Outcomes:
CO1:	Comprehensive Understanding of Electronic Materials
CO2:	Proficiency in Semiconductor Materials
CO3:	Ability to Analyze Material Properties
CO4:	Understanding of Emerging Materials and Technologies
Unit 1:	**Fundamentals of materials science :** **[15]** **Weightage: 15M**
	Relative stability of Phases, Phase rule ,Phase Diagram, Phase Transformations : Elementary idea of Nucleation and Growth, methods of crystal growth. Defects in crystals : Elementary idea of point, line and planar defects. Materials in thin film form : Concept of thin films, preparation of thin films.

Unit 2:	**Special materials in Electronics: [15]** **Weightage: 15M**
	Composite materials : Composites of glasses, polymers metals and ceramics, properties and applications. Polymers : Mechanism of polymerination, conducting polymers, application of polymers in electronics. Metallic Materials : Functional gradient materials, shape memory alloys, amorphous materials, IC package materials. Liquid crystal polymers: Optical properties of cholesteric and chiral nematics liquid crystal displays, optical fibre materials.
Unit 3:	**Semiconductors and Their Role [15]** **Weightage: 15M**
	Introduction, Energy bands in solids, Semiconductors band gap formation Extrinsic semiconductors, Fermi level variations, and conductivity. Introduction to pn junctions and Metal-semiconductor junctions. pn junctions under bias, Junction breakdown, and Heterojunctions. Problem set on Intrisic, extrinsic and pn junction.
Unit 4:	**Concept of organic semiconductors [15]** **Weightage: 15M**
	Concept of organic semiconductors; Charge carrier transport in polymeric and organic semiconductors; Optical properties of organic semiconductors; Charge injection from metals to organic solids; Operating mode of the main plastic electronic devices: Organic light-emitting diodes (OLEDs), organic photovoltaic cells (OPVs) and organic field-effect transistors (OFETs).
	Reference books:
	1. Pallab Bhattacharya "Semiconductor Opto Electronic Devices", Prentice Hall of India Pvt., Ltd., New Delhi, 2006. 2. Jasprit Singh, "Opto Electronics – As Introduction to Materials and Devices", Mc Graw-Hill International Edition, 1998 3. Ben Streetman & Sanjay Banerjee Solid State Electronic Devices, 4. Murthy & Jena: Structure and properties of Engineering Materials ,TMH New Delhi

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **Second Year M.Sc. (Electronics Science) Sem-III** **Vertical: RP** **Course Code: 2320303** **Course Name: Research Project-I**
***Teaching Scheme** **Project work: 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: Research is a critical component of the MSc electronics science program, with students acquiring skills in research methodology, data collection, analysis, and scientific inquiry. By engaging in independent research projects, students are encouraged to develop innovative solutions to complex scientific problems, preparing them for advanced studies and research-oriented careers.

	Course Objectives:
●	To know the basic idea behind the research.
●	To understand the terms for research project like introduction, background and significance, literature and review, research designs and methods, results and discussion, and conclusion etc.
●	To know the data collection and analysis/interpretation of data
●	To know the project report writing and submission.
	Course Outcomes: Students can able to understand -
CO1:	Basic idea behind the research.
CO2:	Terms for research project like introduction, background and significance, literature and review, research designs and methods, results and discussion, and conclusion etc.
CO3:	Knowledge of data collection and analysis/interpretation of data
CO4:	Project report writing and submission.
	Candidates are expected to work on assigned research project and submit the results at the end of the semester in the form a dissertation. Open defense of the student on his/her dissertation shall be arranged. This defense shall be in front of the panel of examiners. This will be valued for 40 marks. Project work involving in-plant training in any of the electronics industry for at least 21 days will be considered. Project should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry / research organization one member of that body can also be included as project guide.

	Guidelines for Assessment • Quality of Literature survey and Novelty in the problem • Clarity of Problem definition and Feasibility of problem solution • Clarity of objective and scope • Quality of work attempted • Presentation skills

Semester IV

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ॥ विद्यया संपन्नता ॥ NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-IV** **Vertical: DSC** **Course Code: 2320401** **Course Name: PLC and SCADA**

***Teaching Scheme** **Lectures: 04 Hours/week, 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: In today's rapidly evolving industrial landscape, automation plays a critical role in ensuring the efficiency, reliability, and scalability of manufacturing and control processes. The PLC and SCADA course is designed to equip students with essential knowledge and skills in two of the most widely used technologies in industrial automation: Programmable Logic Controllers (PLC) and Supervisory Control and Data Acquisition (SCADA) systems. PLC systems are the backbone of industrial automation, enabling the precise control of machinery and processes across industries such as manufacturing, oil and gas, power generation, and water treatment. SCADA systems, on the other hand, provide a centralized platform to monitor, control, and visualize these processes in real-time, ensuring optimal operation and decision-making. his course covers the principles of operation, configuration, programming, and troubleshooting of PLCs, alongside the architecture, communication protocols, and functionality of SCADA systems. Through hands-on exercises and real-world case studies, students will gain practical experience in designing, implementing, and managing automation systems that improve operational performance. By the end of the course, students will be well-versed in the integration of PLCs and SCADA, providing them with the technical expertise needed to succeed in a wide range of industries where automation is essential.

	Course Objectives:
•	To understand the Understanding the Basics of PLCs
•	To study Designing and Implementing PLC-based Control Systems
•	To aware of PLC Programming Skills
•	To Understanding SCADA Architecture and Components
	Course Outcomes:
CO1:	Comprehensive Understanding of PLC and SCADA Systems
CO2:	The student study Design and Implementation of Automation Solutions
CO3:	Proficiency in PLC Programming
CO4:	Development of SCADA Applications
Unit 1:	**Fundamentals:** **[15]** **Weightage: 15M**

	RS-232 interface standard, The RS-485 interface standard, OSI reference model, TCP/IP overview, Internet layer protocols (packet transport), Modbus protocol, CAN-bus, Introduction to HART and smart instrumentation .
Unit 2:	**Types of plant and control: (15)** **Weightage: 15M**
	Types of plant and control – categories in industry, open loop and close loop control functions, Control modes: - Discontinuous-two position, multi position, floating control, Continuous –proportional, integral, derivative & composite modes.
Unit 3:	**Programmable Logic Controller (PLC) (15)** **Weightage: 15M**
	functional diagram, operation, programming. PLC system, I/O modules and interfacing, processor, construction of PLC ladder diagrams, PLC Programming. Ladder diagrams for process control, Relay Logic Ladder Diagram, PLC Timers and Counters: data transfer & program control instructions, advanced PLC instructions, PID Control using PLC.
Unit 4:	**Introduction to Supervisory Control and Data Acquisition (SCADA): (15)** **Weightage: 15M**
	Introduction to Supervisory Control and Data Acquisition (SCADA): Architecture, communication requirements and applications, Introduction to DCS, architecture of DCS, Introduction to DCS Programming, HMI, MTU- functions of MTU, RTU-Functions of RTU, PID controller, State Space Method – Controllability and Observability, Full-state feedback Regulators Tracker, Regulator design by pole placement
	Reference books:
	1. Pop povik Bhatkar, Distributed Computer Control in Industrial Automation‖, CRCpress, 2nd edition 2. S.K.Singh, Computer Aided Process Control‖, Prentice Hall of India, 1st Edition, 2004. 3. Krishna Kant, Computer Based Process Control‖, Prentice Hall of India, 2nd edition,2010. 4. N.E. Battikha, The Management of Control System: Justification and TechnicalAuditing‖, International Society of Automation, 1st Edition, 1992. 5. Gary Dunning, Introduction to Programmable Logic controller‖, Thomas Learning, Pckedition, 2001. 6. John. W. Webb, Ronald A Reis, ―Programmable Logic Controllers – Principles andApplications‖, Prentice Hall Inc, 5th Edition, 2002. 7. Bela G. Liptak, Instrument engineers handbook- Process control‖, Chilton bookcompa 3rd edition, 1969. 8. D.J. Smith , K.G.L. Simpson, ―Functional Safety: A Straightforward Guide to IEC61508and Related Standards‖, Butterworth-Heinemann Publications, 2nd Edition, 2004.

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-IV** **Vertical: DSC** **Course Code: 2320402** **Course Name: Integrated Circuits and VLSI**
***Teaching Scheme** **Lectures: 04 Hours/week, 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: This course offers a comprehensive exploration of IC design principles and VLSI technology, focusing on the design, fabrication, and testing of both digital and analog integrated circuits. Students will learn about the underlying semiconductor technology, the process of transistor-level design, layout techniques, and the methodologies involved in integrating millions of transistors onto a single chip. The course bridges the gap between theory and practice, providing hands-on experience with modern design tools and simulation software. Students will gain insight into critical aspects of IC and VLSI design, including power efficiency, speed optimization, design for manufacturability, and reliability. With the continuous growth of fields such as artificial intelligence, IoT, and communication systems, understanding VLSI and IC technology is essential for anyone aspiring to work in electronics and semiconductor industries. By the end of the course, students will have a thorough understanding of integrated circuit design and the challenges involved in developing next-generation VLSI systems, preparing them for both industry roles and advanced academic research.

	Course Objectives:
•	Understanding the Fundamentals of IC and VLSI Technology
•	To Design of Digital integrated Circuits
•	To know CMOS Technology and Circuit Design
•	Optimization for Performance, Power, and Area
•	Exposure to Emerging Trends in IC and VLSI
	Course Outcomes:
CO1:	The students can able to Comprehensive Knowledge of IC and VLSI Concepts
CO2:	The students know about Proficiency in Circuit Design
CO3:	The students can able to explain of CMOS Technology
CO4:	The students can able to know Knowledge of Design for Manufacturability
CO5:	Hands-on Experience with Design Tools
Unit 1:	**Basic Physics of MOS Devices** **[15]** **Weightage: 15M**
	MOS Device structure and physical operation, MOS I-V characteristics, Second order effects in MOS devices, MOS structure capacitances, Small signal model of MOS, Long channel and short channel devices. **Current sources and Amplifier Design**

	Basic and cascode current mirrors, Single stage Amplifies: Basic concepts, Common source stage, Common gate stage, Cascode stage. Differential amplifiers: Differential and common mode operations.
Unit 2:	**CMOS Inverter** [**15]** **Weightage: 15M**
	CMOS Inverter: Transfer characteristics, MOS transistor circuit model, latch-up in CMOS circuits. Static and Dynamic behavior of CMOS Inverter MOS circuit design fundamentals: MOS layers, stick diagrams, lambda-based rules for NMOS and CMOS process, layout diagrams, Static and dynamic power consumption in CMOS Inverter.
Unit 3:	**CMOS combinational and Sequential circuit Design** [**15]** **Weightage: 15M**
	Static CMOS logic design: Complementary CMOS design, DCVSL, Ratioed logic, Pass Transistor logic, Transmission gate logic. Dynamic CMOS logic design: Basic Principles, Speed and power dissipation, Issues in Dynamic design, cascading in dynamic design. Static latches and registers, Dynamic latches and registers, Alternative register styles: Pulse registers and Sense based amplifiers, Latch vs. Register- based pipelines structures, NORA-CMOS design.
Unit 4:	**Timing issues in Digital circuits:** **[15]** **Weightage: 15M**
	Classification of Digital systems, Basics of synchronous timing, clock distribution networks, Synchronizers and arbiters.
Unit 5:	**Emerging Tools:** **[15]** **Weightage: 15M**
	CAD VLSI tools, Hierarchical design of VLSIs, behavioral description, RTL, Logic circuit, gate, circuits, Xilinx, SPICE. ASIC Design Flow: Partitioning, Floor planning , placement, global and channel routing. Latest trends in VLSI circuit design.
	Reference books:
	1. Digital Integrated Circuits: A Design Perspective- Jan M. Rabaey, AnanthaChadrakasan, Borivoje Nikolic, E,PHI 2005. 2. Design of Analog CMOS Integrated Circuits-Behzad Razavi, McGraw-Hill, 2000. 3. Microelectronic circuits: Theory and applications- Adel Sedra, Kenneth Smith, Oxford University Press,6E-2013. 4. Analysis & Design of Analog Integrated Circuits, P. Gray, P. Hurst, S. Lewis, R. Meyer, Wiley 5. Application Specific Integrated Circuits, M.J. S. Smith, Addison-Wesley Basic 6. VLSI Design- Douglas A. Pucknell

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-IV** **Vertical: DSE (3A)** **Course Code: 2320405** **Course Name: Python and Machine Learning**
***Teaching Scheme** **Lectures: 04 Hours/week, 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: In the age of big data and artificial intelligence, the ability to analyze and derive insights from vast amounts of information is more critical than ever. The **Python and Machine Learning** course is designed to provide students with the foundational skills and knowledge needed to harness the power of Python programming in the rapidly evolving field of machine learning. Python has emerged as one of the most popular programming languages for data science and machine learning due to its simplicity, versatility, and rich ecosystem of libraries and frameworks. This course will introduce students to the essential concepts of machine learning, including supervised and unsupervised learning, feature engineering, model evaluation, and optimization, all while leveraging Python libraries such as NumPy, pandas, scikit-learn, and TensorFlow.

	Course Objectives:
•	Understanding Python Fundamentals
•	To know Data Manipulation and Analysis Skills.
•	To Understanding of Machine Learning Concepts
•	To Implementation of Machine Learning Algorithms
	Course Outcomes:
CO1:	The student is Proficiency in Python Programming
CO2:	Data Manipulation and Analysis
CO3:	Foundational Concepts of Machine Learning
CO4:	Implementation of Machine Learning Algorithms
Unit 1:	**Fundamental :** **[15]** **Weightage: 15M**
	Introduction to Python programming, Installation and running python programs, print function, variables and data types, arithmetic and logical operators
Unit 2:	**Decision and control statements** **[15]** **Weightage: 15M**
	Decision and control statements, loops structures, list, tuple, dictionary, functions, file handling Pickle, shelve, Json, object oriented programming in python .

Unit 3:	**Advance python** **[15]** **Weightage: 15M**
	Numpy, Scipy, pandas, Matplotlib
Unit 4:	**Basics of Machine Learning:** **[15]** **Weightage: 15M**
	Introduction to Machine learning, Scikitlean, Cat boost, H2O, XG Boost, light gbm, imbalanced-learn, Anaconda and Jupyter notebook, Types and Structure of data. Kaggle database. (Only introduction, features and applications)
Unit 5:	**Machine Learning Algorithm :** **[15]** **Weightage: 15M**
	Supervised Algorithm in ML: introduction, Classification and Regression, Linear Models, Support Vector Machines, Stochastic Gradient Descent, Nearest Neighbors, Decision Trees, Ensemble methods, Cat boost, xg boost, H2O, Light gbm (Apply supervised Algorithm at least two dataset form Kaggle) Unsupervised Algorithm in ML: Clustering, Bi clustering, PCA (Apply Unsupervised Algorithm at least two dataset form Kaggle)
Unit 6:	**Case Studies :** **[15]** **Weightage: 15M**
	Case study: Heart disease data, wine / water quality, Costumer segmentation, Online data set form Scikit learn (Saving ML models, Deployment of ML Model on local)
	Reference books:
	1. Learning Python Powerful Object-Oriented Programming by Mark Lutz **2.** Core Python Programming Black Book by R Nageswara Rao **3.** Python 3 for Absolute Beginners by Tim Hall, J-P Stacey **4.** Hands-On Machine Learning with Scikit-Learn by Geron Aurelien **5.** Introduction to Machine Learning with Python: A Guide for Data Scientists by Andreas Muller **6.** Machine Learning for Absolute Beginners by Oliver Theobald

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-IV** **Vertical: DSE** **Course Code: 2320406** **Course Name: Biomedical Electronic Instrumentation**
***Teaching Scheme** **Lectures: 04 Hours/week, 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: This course explores the various types of biomedical instruments, including sensors, transducers, and diagnostic devices, that are essential for capturing and analyzing physiological signals from the human body. Students will learn about the design, operation, and application of instrumentation used in medical imaging, patient monitoring, clinical diagnostics, and therapeutic devices. Emphasizing the interdisciplinary nature of the field, this course integrates concepts from engineering, biology, and medicine to equip students with the knowledge necessary to develop and improve medical devices. Topics will include signal processing, data acquisition, the design of measurement systems, and regulatory considerations in medical device development. By the end of the course, students will be well-prepared to contribute to advancements in biomedical technology, improve patient care, and address the complex challenges faced in the healthcare industry, making them valuable assets in the rapidly growing field of biomedical engineering.

	Course Objectives:
•	Understanding the Fundamentals of Biomedical Instrumentation
•	Knowledge of Sensor and Transducer Technologies
•	Design and Analysis of Measurement Systems
•	Exploration of Emerging Trends
	Course Outcomes:
CO1:	Proficiency in Biomedical Instrumentation Principles
CO2:	Competence in Sensor and Transducer Technologies
CO3:	Design and Analysis Skills for Measurement Systems
CO4:	Familiarity with Emerging Trends in the Field
Unit 1:	**Bioelectric Signals** **[15]** **Weightage: 15M**
	Introduction to physiological systems, Sources of biomedical signals. The origin of Bioelectric signal: Resting and Action potentials, Propagation of action potentials. Introduction to bioelectric signals: ECG, EEG, EMG.
Unit 2:	**Study of Bioelectric Electrodes** **[15]** **Weightage: 15M**

	Introduction to electrode theory, Silver-Silver Chloride electrode, Classification of bioelectric electrodes, Microelectrodes: Metal and micropipette. Surface electrodes: Limb & Floating electrode, ECG Leads, Suction-cup electrode, fluid Column electrode, Pad electrode. Needle electrode
Unit 3:	**Fundamentals of Biomedical Instrumentation System [15]** **Weightage: 15M**
	Basic architecture of medical instrumentation system, preamplifiers, differential amplifiers, instrumentation amplifiers, Isolation amplifier, Sources of the noise
Unit 4:	**Monitoring System [15]** **Weightage: 15M**
	Electrocardiograph (ECG): Basic principle, block diagram of ECG. Electroencephalograph (EEG): Basic principle, block diagram of EEG. Electromyograph (EMG): Basic principle, block diagram of EMG
Unit 5:	**Imaging System**
	Basic of Diagnostics radiology, Block diagram of x- ray machine, Principles of Ultrasound: properties, mode of transmission and imaging.
	Reference books:
	Reference books: 1. Handbook of Biomedical Instrumentation, -R.S. Khandpur, 2nd edition, TMH, New Delhi Reprint 2007 2. Introduction to Biomedical Equipment Technology- J.J.Carr& J.M. Brown, PHI1993. 3. Biomedical Instrumentation and Measurements –Cromwell, Weibell& Pfeiffer, PHI 2nd Ed.

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **Second Year M.Sc. (Electronics Science) Sem-IV** **Vertical: DSE** **Course Code: 2320407** **Course Name: Modern Communication System**

***Teaching Scheme** **Lectures: 04 Hours/week, 04 Credits**	***Examination Scheme** **UA: 60 Marks** **CA: 40 Marks**

Course Preamble: The evolution of communication systems has been driven by the need for faster, more reliable, and efficient transmission of information. This course will delve into the key technologies that have emerged, such as digital modulation, coding theory, signal processing, and wireless communication. Students will gain an understanding of how information is transmitted, the role of various hardware and software components, and the protocols that ensure data integrity and security. As we stand on the cusp of further innovations like 5G, the Internet of Things (IoT), and quantum communication, this course aims to equip students with both theoretical knowledge and practical skills to contribute to the ever-evolving field of communication technology. Through this course, students will be exposed to not only the foundational concepts of communication systems but also the latest advancements that shape our digital world. By the end, they will have a comprehensive understanding of modern communication architectures and be prepared to address the challenges and opportunities that lie ahead.

	Course Objectives:
•	Understand Core Principles
•	Learn Modern Communication Technologies
•	Study Coding and Modulation
•	Understand Communication Protocols
	Course Outcomes:
CO1:	Mastery of Communication System Fundamentals
CO2:	Application of Modulation and Coding Techniques
CO3:	Practical Skills in System Design
CO4:	Understanding of Protocols and Standards
Unit 1:	**Antenna Basics** **[15]** **Weightage: 15M**
	Introduction, basic antenna parameters, patterns, beam area, radiation intensity, beam efficiency,directivity and gain, antenna apertures, effective height, bandwidth, radiation, efficiency, Antenna Types: Horn antennas, rectangular horn antennas, helical Antenna, Yagi-Uda array,corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, omni- directional antennas, antennas for satellite, antennas for ground penetrating radars.

Unit 2:	**Digital Communication** **[15]** **Weightage: 15M**
	FDM, TDM, FDMA, TDMA, CDMA and OFMDA, Digital modulation technique: PCM, ASK, FSK, PSK, BPSK, QPSK and QAM. PAM,PWM,PPM, Delta modulation, Adaptive delta modulation, Digital modulation techniques- ASK, FSK, PSK, QAM, M-ary digital modulation techniques. Digitalbaseband transmission. Coding Techniques- Introduction to the Coding, Alpha – Numeric coding, Parity Check Coding, Hamming Code, Concept of Systematic Code, RZ, NRZ, Manchester code, AMI, Error Detection and Error Correction.
Unit 3:	**Advanced Communication System** **[15]** **Weightage: 15M**
	Satellite Communication, Satellite for Television applications: Direct-To-Home (DTH) and Cable TV. Voice and Data communication, Earth observation (Remote Sensing) applications, Military applications. GSM ,Principle of digital telephony. Cellular Phones concept, Frequency reuse, Capacity expansion techniques- Cell splitting and cell sectoring, working of a typical cellular system.
Unit 4:	**Introduction to Intelligent Vehicular Communication** **[15]** **Weightage: 15M**
	Evolution, Vehicular Networks and ITS, Vehicular Communication Standards/ Technologies – DSRC, IEEE 802.11p WAVE, IEEE 1609, IEEE 802.15.7 - Visible Light Communication (VLC), 4G/5G-Device to Device (D2D), 6G Cellular Networks and Connected Autonomous Vehicles, Operational Scenario – Collision Avoidance.
	Reference books:
	Reference books: 1. Communication Electronics – Frenzel (TMGH) 2. Analog and Digital Communication Systems – Martin S. Roden 3. Digital and Data Communications – Martin (PHI) 4. Hand Book of Electronic Communications – Miller 5. Mobile Communication – Shiller

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **Second Year M.Sc. (Electronics Science) Sem-IV** **Vertical: RP** **Course Code: 2320403** **Course Name: Research Project-II**
***Teaching Scheme** **Project work: 06 Credits**	***Examination Scheme** **UA: 90 Marks** **CA: 60 Marks**

Course Preamble: Research Project is one of the core courses in the Electronics Science curriculum and one of the traditional courses, dating back from the last many centuries. This course provides an in-depth understanding of the fundamental concepts in Project work involving in-plant training in any of the Electronics Science. The course aims to develop research skills in Electronics Science.

	Course Objectives:
•	To know the basic idea behind the research.
•	To understand the terms for research project like introduction, background and significance, literature and review, research designs and methods, results and discussion, and conclusion etc.
•	To know the data collection and analysis/interpretation of data
•	To know the project report writing and submission.
	Course Outcomes: Students can able to understand the -
CO1:	Basic idea behind the research.
CO2:	Terms for research project like introduction, background and significance, literature and review, research designs and methods, results and discussion, and conclusion etc.
CO3:	Knowledge of data collection and analysis/interpretation of data
CO4:	Project report writing and submission.
•	Candidates are expected to work on assigned research project and submit the results at the end of the semester in the form a dissertation. Open defense of the student on his/her dissertation shall be arranged. This defense shall be in front of the panel of examiners. This will be valued for 40 marks.

	Project work involving organic synthesis/evaluation in-plant training in any of the Electronics Science for at least 21 days will be considered. Project should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry / research organization one member of that body can also be included as project guide. **Guidelines for Assessment** • Quality of Literature survey and Novelty in the problem • Clarity of Problem definition and Feasibility of problem solution • Clarity of objective and scope • Quality of work attempted • Presentation skills

Nature of Examination:
Each semester will have theory external assessment examination of 60 marks each (2.5 hrs. duration) and 40 marks college assessment. The practical examination of Semesters III to IV will be conducted at the end of each semester. Duly certified copy of laboratory record must be produced at the time of examination.

Practical Examination of M. Sc. II
The practical examination will be of 3 days for each semester.

Semester III:

Practical courses each : 30 (UA)+ 20 (CA)
Research Project work : 60 (UA) + 40 (CA)

Semester IV:

Practical courses each : 30 (UA)+ 20 (CA)
Research Project work : 90 (UA) + 60 (CA)

** The evaluation of Research Project will be done by both external and internal examiners at the time of examination.

Nature of question paper (M. Sc. II):

Time: 2 ½ hours Maximum Marks: 60

Instructions

1. All questions are compulsory
2. All questions carry equal marks.
3. Figures to the right indicate full marks.
4. Use of log tables and calculators is allowed.

Question Paper

Q 1. A) Choose correct alternative **Marks 8 (1 x 8)**

Sub-questions (i) to (viii)

B) Fill in the blanks **Marks 4 (1 x 4)**

Sub questions (i) to (iv)

Q 2. Answer the following (any six) **Marks 12 (2 x 6)**

Sub-questions (a) to (h)

Q 3. Answer the following (any three) **Marks 12 (3 x 4)**

Sub-questions (a) to (d)

Q 4. Answer the following (any two) **Marks 12 (6 x 2)**

Sub-questions (a) to (c)

Q 5. Answer the following (any two) **Marks 12 (6 x 2)**

Sub-questions (a) to (c)

****