SHIVAJI UNIVERSITY, KOLHAPUR
416 004, MAHARASHTRA
PHONE : EPABX – 2609000, BOS Section – 0231-2609094, 2609487
Web : www.unishivaji.ac.in Email: bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर ४१६ ००४, महाराष्ट्र
दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४, २६०९४८७
वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in

Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SU/BOS/Sci & Tech/ 316 **Date: 23/05/2025**

To,

The Director,
School of Engineering and Technology,
Shivaji University, Kolhapur.

Subject: Regarding revised syllabus of **B. Tech.** Part - III (Sem - V & VI) degree **Programme (Deparment of Technolgy)** under the Faculty of Science and Technology as per NEP 2020.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, Nature of Question paper and equivalence of B. Tech. Part - III (Sem - V & VI) under the Faculty of Science & Technology as per NEP 2020.

No.	Course Syllabus
1	Civil Engineering
2	Mechanical Engineering
3	Computer Science and Technology
4	Chemical Engineering
5	Electronics and Telecommunication Engineering
6	Food Technology

This Syllabus, shall be implemented from the academic year **2025-26** onwards. A soft copy containing the syllabus is attached herewith and it is available on university website **www.unishivaji.ac.in NEP-2020@suk (Online Syllabus).**

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October/ November 2025 & March / April 2026. These chances are available for repeater students, if any

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dr. S. M. Kubal
Dy. Registrar

Copy to: for Information and necessary action

1	The I/c Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations & Evaluation	7	Affiliation Section (T.1) (T.2)
3	The Chairpersan, Respective Board of Studies	8	P.G.Admission Section, /P.G Seminar Section
4	OE 4 Exam Section,	9	Computer Centrev/ IT Cell
5	Eligibility Section,	10	Internal Quality Assorance Cell (IQAC)

Shivaji University
Vidya Nagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Third Year B. Tech (Electronics and Telecommunication Engineering), Detailed Curriculum 2025-26 onwards

A. Component wise distribution of credits

(Expected range of credits as per AICTE & NEP2020 guidelines is 160-176)

Sr. No.	Category Suggested	Course Code	No. of Credits	Components %
1.	Humanities and Social Sciences including Management & Environment Courses	HSMEC	04	2.27
2.	Indian Knowledge System	IKS	05	2.84
3.	Ability Enhancement Course	AEC	03	1.70
4.	Value Education Courses	VEC	02	1.14
5.	Basic Science courses	BSC	27	15.34
6.	Engineering Science Courses including workshop, drawing, basics of civil/electrical/mechanical/computer etc.	ESC	34	19.32
7.	Professional Core Courses	PCC	54	30.69
8.	Professional Elective Courses relevant to chosen specialization/branch	PEC	06	3.41
9.	Open subjects – Electives from other technical and /or emerging subjects	OEC	12	6.82
10.	Project , Seminar and Internship	PSI	15	8.52
11.	Multidisciplinary Minor	MDM	14	7.95
11.	Vocational and Skill Enhancement Courses	VSEC	Audit Courses	-
12.	Project Based Learning	PBL		
13	Mandatory Audit Courses [Some other courses Decided at the Institute level but that do not get fit in the credits]	MAC (HSMEC)*		
	Total		176	**100**

* Please note that most of the courses under HSMEC have been covered under audit courses.

B. Engineering Graduate Attributes

1. Domain specific Engineering Knowledge
2. Problem Analysis Ability
3. Acquiring Skills that enable them to Design & Develop Solutions to the Problems
4. Capacity to investigate Complex Problems
5. Familiarity of using Modern Tools
6. Understanding Engineer's role and connectivity towards Society
7. Awareness about Environment & Sustainability
8. Practicing ethics and values
9. Ability to work as an Individual & in a Team also
10. Acquiring Communication skills
11. Becoming well verse with task of Project management & Finance aspects
12. Developing Lifelong Learning attitude

C. B. Tech (Electronics & Telecommunication Engineering) Program: Vision, Mission, PEOs and POS.

Vision

To develop competent professionals in electronics and communication engineering to serve industry, academia and society.

Mission

- To provide strong foundation of basic sciences, mathematics and electronics engineering to graduates.
- To create awareness of social, cultural, technological issues and inculcate strong ethical principles among graduates.
- To develop technological professionals with leadership, management and team qualities.
- To pursue continuous improvement in knowledge and skills.

Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) provides a clear vision for the long-term achievements of your program's graduates, guiding curriculum design and teaching practices to align with industry and societal needs. PEOs also serve as benchmarks for assessing program success and ensuring that graduates are prepared for their careers and lifelong learning.

PEO 1- Providing strong fundamentals to graduates in Mathematics, Science and Engineering to enable them to provide solutions for problems in electronics, communications and other relevant disciplines.

PEO 2- Provide sound theoretical and practical knowledge in electronics and communication engineering to enable them to contribute in growth of industry and progress of society.

PEO 3- Development of analytical and thinking abilities for research and development activities, leadership and entrepreneurship.

PEO 4- Motivate the qualities required for team work, inter-personal communications, and professional skills and to act as good human being and responsible citizenship.

Program Outcomes (POs)

Program Outcomes provide a clear roadmap for the education and development of Electronics & Telecommunication engineering students, ensuring that your program is effective, relevant, and aligned with industry standards and expectations.

1. **Domain Specific Engineering Knowledge:** Apply principles from mathematics, physics, chemistry, and engineering to solve complex Electronics & Telecommunication engineering problems.
2. **Problem Analysis Ability:** Develop skills to analyse and solve problems encountered in Electronics & Telecommunication and allied industries and consultancy services.
3. **Acquiring Skills to Design/Develop Solutions to Problems:** Design and manage Electronics & Telecommunication processes and systems while considering current and emerging industrial practices.
4. **Capacity to Investigate Complex Problems:** Identify new research areas and utilize advanced research methods to analyse data and draw conclusions, aiming for innovative solutions in Electronics & Telecommunication engineering.
5. **Modern Tool Usage:** Select and apply modern engineering and IT tools, including modeling and prediction techniques, to complex engineering tasks.
6. **The Engineer's Connectivity with Society:** Assess and address societal, health, safety, legal, and cultural issues with informed engineering judgement.
7. **Environment and Sustainability Awareness:** Understand and integrate environmental impacts and sustainability into engineering solutions.
8. **Practicing Ethics and Values:** Uphold professional ethics and responsibilities in engineering practice.

9. **Ability to Work as an Individual and in Team:** Work effectively both individually and as a part of diverse and multidisciplinary teams.
10. **Acquiring Communication Skills:** Communicate complex engineering information effectively through written reports, presentations, and interpersonal communication.
11. **Well Versed with Task of Project Management and Finance Aspects:** Apply engineering and management principles to lead and manage projects in multidisciplinary environments.
12. **Life-Long Learning Attitude:** Recognize and engage in lifelong learning to stay abreast of technological advancements in engineering.

Shivaji University, Kolhapur
Department of Technology

Third Year B.Tech (Electronics & Telecommunication Engineering), Semester- V

Teaching & Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Engineering Science Course	ESC311	Electromagnetic Fields	03	01	-	04	04	30:70	50:00
2.	Professional Core Course	PCC311	Power Electronics	03	-	02	05	04	30:70	00:50
3.	Professional Core Course	PCC312	Microcontrollers	03	-	02	05	04	30:70	00:50
4.	Professional Core Course	PCC313	Digital Signal Processing	03	-	-	03	03	30:70	00:00
5.	Professional Core Course	PCC314	Advanced Programming Techniques	02	-	02	04	03	30:70	00:50
6.	MDM Course	MDM 311	Multidisciplinary Minor Course II*	03	-	-	03	03	30:70	00:00
7.	Project Based Learning	PBL311	Mini Project –I	-	-	02	02	01	-	50:00
8.	Ability Enhancement Courses	AEC311	Introduction to Foreign Language	01	-	-	01	01	-	50:00
							-	**23**	**600**	**300**
9.	Mandatory Audit Course	MAC311	Aptitude Enhancement Course II	02	-	-	02	IE at Course in charge end		
			Total Hours	20	01	08	**29**	-	-	-

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (Electronics and Telecommunication Engineering), Semester- VI

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Engineering Science Course	ESC321	Antenna & Wave Propagation	03	-	02	05	04	30:70	50:00
2.	Professional Core Course	PCC321	Control Systems	03	01	-	04	04	30:70	50:00
3.	Professional Core Course	PCC322	VLSI Design	03	-	02	05	04	30:70	00:50
4.	Professional Core Course	PCC321	Program Elective –I	03	-	02	05	04	30:70	00:50
5.	Program Elective Course	OE 321	Open Elective-I	03	-	-	03	03	30:70	00:00
6.	MDM Course	MDM 321	Multidisciplinary Minor Course III*	03	-	-	03	03	30:70	00:00
7.	Ability Enhancement Course	AEC321	Mini Project & Industrial Visit	-	-	02	02	01		50:50
							-	**23**	**600**	**300**
8.	Vocational and Skill Enhancement Course	VSEC321	Design Thinking & Innovation – III	01	-	-	01	IE at Course in charge end		
9.	Mandatory Audit Course	MAC 321	Aptitude Enhancement Course III	02	-	-	02	IE at Course in charge end		
			Total Hours	21	01	08	**30**	-	-	-

*Note: The MDM course will be from the chosen multidisciplinary title.

List of Program Elective – I

1. ARM & Embedded systems
2. Computer Networks
3. Optical Fiber Communication

List of Open Elective – I

1. Industrial Organization and Management
2. Professional Communication

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">ESC311</td></tr>
<tr><td>Course Category</td><td colspan="5">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Electromagnetic Fields (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>01</td><td>--</td><td>04</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3">ISE: 30</td><td>ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Engineering Mathematics 3, Analog and Digital Communication Engineering</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Electromagnetic Field course is designed to provide students with a fundamental understanding of electric and magnetic fields, their interactions, and their applications in modern engineering and technology.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Study of physical interpretation of vectors , integral and differential operators for electromagnetics.
2. Study of the physical interpretation and application of laws and theorems of electric fields
3. Describe the physical interpretation and application of laws and theorems of magnetic fields.
4. To know field equations from Maxwell’s Equations
5. To explain fields under time varying situations & effect of materials on electric and magnetic fields
6. To describe transmission line parameters and derive equation for transmission line</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon successful completion of this course, the student will be able to:
1. Explain physical interpretation of vectors ,integral and differential operators for electromagnetics
2. Understand the physical interpretation and application of laws and theorems of electric fields
3. Describe the physical interpretation and application of laws and theorems of magnetic fields.
4. Develop field equations from Maxwell’s Equations
5. Analyse fields under time varying situations & effect of materials on electric and magnetic fields
6. Identify transmission line parameters and derive equation for transmission</td></tr>
</table>

	line

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	1	1								
CO 2	3	3	1	1								
CO 3	3	3	1	1								
CO 4	3	3	1	1								
CO 5	3	3	1	1								
CO 6	3	3	1	1								

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Introduction** Introduction and Significance of Electromagnetic Fields, Vector Analysis, Calculus, Coordinate Systems, Concepts of Gradient, Divergence and Curl.	07
2	**Electrostatic Field** Coulomb's Law, Electric Field Intensity, Electric Field due to Distributed Charges, Flux Density, Gauss Law and Applications, Divergence Theorem, Work Done, Electric Potential, Potential Gradient, Electric Dipole, Polarization, Electrostatic Energy Density, Boundary Conditions for Electrostatic Field.	06
3	**Magnetostatic Field** Biot-Savart Law, Ampere's Circuital Law and Application, Stoke's Theorem, Magnetic Flux Density, Magnetic Scalar & Vector Potential, Energy Stored in Magnetic Field, Boundary Conditions for Magnetic Field.	07
4	**Maxwell's Equations** Continuity Equation for Static Conditions, Displacement Current, Faraday's Law, Inconsistency of Ampere's Law, Maxwell's Equations in Point and Integral Form, Maxwell's Equations for Time Varying Fields, Comparison of Field & Circuit Theory	07
5	**Uniform Plane Wave** Wave Propagation in Perfect Dielectric, Lossy Dielectric and Conducting Media, Wave Equations for Sinusoidal Time Variations, Poynting Theorem and Power Flow in Electromagnetic Field, Skin Depth, Phase Velocity and Group Velocity.	06
6	**Transmission Lines** Types of Transmission Lines, Transmission Line Equation, Transmission Line Parameters, The Terminated Transmission Line, Reflection Coefficient, VSWR, Group Velocity, Phase Velocity, Impedance Matching Techniques, Smith Chart and Applications.	06
General Instructions: Based on the syllabus content students have to complete any one of the following activities:		

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz

5. Solve home assignments

6. Question paper will be based on all six units covering of theory , derivations and numericals.

Sr. No.	Reference Books
1	William Hayt, "Engineering Electromagnetics", Mc Graw Hill.
2	R.K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill India,
3	Matthew. N.O. Sadiku, "Elements of Electromagnetics", Oxford University Press
4	E.C. Jordan & K.G. Balmain, "Electromagnetic waves & Radiating Systems", Prentice Hall, India
5	K.D. Prasad, "Antenna & Wave Propagation" Satya Prakashan
6	N. Narayana Rao, "Elements of Engineering Electromagnetics", Prentice Hall
7	Griffiths David J, "Introduction to Electrodynamics", Pearson Education
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

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<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">ESC311</td></tr>
<tr><td>Course Category</td><td colspan="5">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Electromagnetic Fields (Tutorial)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>01</td><td>-</td><td>01</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3">-</td><td>IE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Engineering Mathematics 3, Analog and Digital Communication Engineering</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Electromagnetic Field course is designed to provide students with a fundamental understanding of electric and magnetic fields, their interactions, and their applications in modern engineering and technology.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Study of physical interpretation of vectors , integral and differential operators for electromagnetics.
2. Study of the physical interpretation and application of laws and theorems of electric fields
3. Describe the physical interpretation and application of laws and theorems of magnetic fields.
4. To know field equations from Maxwell’s Equations
5. To explain fields under time varying situations & effect of materials on electric and magnetic fields
6. To describe transmission line parameters and derive equation for transmission line</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon successful completion of this course, the student will be able to:
1. Explain physical interpretation of vectors ,integral and differential operators for electromagnetics
2. Understand the physical interpretation and application of laws and theorems of electric fields
3. Describe the physical interpretation and application of laws and theorems of magnetic fields.
4. Develop field equations from Maxwell’s Equations
5. Analyse fields under time varying situations & effect of materials on electric and magnetic fields
6. Identify transmission line parameters and derive equation for transmission</td></tr>
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	line

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	1	1								
CO 2	3	3	1	1								
CO 3	3	3	1	1								
CO 4	3	3	1	1								
CO 5	3	3	1	1								
CO 6	3	3	1	1								

Level of Mapping as: Low 1, Moderate 2, High 3

	Course Content	**Hours**
1	Examples on dot product, cross product and coordinate systems	**1**
2	Examples on curl, divergence and gradient	**1**
3	Examples on Coulomb's Law, Electric Field, Electric Flux Density, Potential	**1**
4	Gauss Law and application	**1**
5	Boundary Conditions for Electrostatic Field	**1**
6	Examples on Biot-Savart Law, Ampere's Circuital Law and Application	**1**
7	Boundary Conditions for Magnetic Field.	**1**
8	Maxwell's Equations in point and integral form, Maxwell's equation for time varying fields	**1**
9	Wave Propagation, Poynting Theorem and Power Flow, Skin Depth, Phase and Group Velocity	**1**
10	Transmission Line Parameters, Reflection Coefficient, VSWR	**1**
11	Any other tutorial based on above syllabus.	**1**

General Instructions:

1. Minimum 8 tutorials should be carried out based on course contents. At-least one tutorial must be conducted on every unit.
2. Batch wise tutorials are to be conducted. The number of students per batch should be as per the practical batches.
3. Students should be encouraged to solve problems using different mathematical software's like MATLAB, Scilab etc.

Sr. No.	**Reference Books**
1	William Hayt, "Engineering Electromagnetics", 8th Edition, Mc Graw Hill

2	Matthew. N.O. Sadiku, "Elements of Electromagnetics", Fourth Edition, Oxford University Press, First Indian Edition 2007
3	R.K Shevgaonkar "Electromagnetic Waves", Tata McGraw-Hill
4	John D. Kraus, "Electromagnetics with Applications", Fifth edition, McGraw-Hill
5	C.A. Balanis "Advanced Engineering Electromagnetics", 2nd Edition, John Wiley & Sons
Sr. No.	**Important web references**
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<table>
<tr><td>Year, Program, Semester</td><td colspan="6">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC 311</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional core course</td></tr>
<tr><td>Course title</td><td colspan="6">Power Electronics (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>--</td><td>02</td><td colspan="2">05</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3">ISE: 30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="6">Electronics Circuit Design, Analog Electronics</td></tr>
<tr><td>Course Rationale</td><td colspan="6">The course contains power processing electronic circuits like controlled rectifiers, AC voltage controllers, DC-DC converters and inverters. Course introduces the basics of power semiconductor devices like SCRs, power BJTs, IGBTs and MOSFETs. The analysis of power circuits presented in detail along with the waveforms and control techniques</td></tr>
<tr><td>Course Objectives</td><td colspan="6">1. Explain the Difference between power devices and low power devices.
2. Explain internal mechanism, limitations of the different power devices
3. Analyze configurations of controlled rectifier circuit.
4. Analyze chopper circuits and its voltage control methods.
5. Explain different Inverter Circuits.
6. Explain different application of power electronics in industry</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">1. Describe structure and working of power devices
2. Analyze triggering methods, Commutation methods and protection circuits used for SCR
3. Calculate different parameters of controlled rectifier
4. Calculate different parameters of chopper circuit
5. Describe different inverters and industrial application of power devices
6. Demonstrate and validate power electronics circuits in the laboratory</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	3	3							1
CO 2	3	2	3	3	3							1
CO 3	3	2	3	2	3							1
CO 4	3	2	3	3	3							1
CO 5	2	2	3	2	3							1
CO 6	3	2	3	3	3							2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Power Devices & Driving Circuits** Construction, working, V-I Characteristics: Power Diode, Power BJT, Schokkttey Diode, Diac, Triac, GTO, MOSFET, IGBT.	07
2	**Silicon Controlled Rectifier** SCR, Construction, V-I Characteristics, gate triggering Characteristics, rating & specifications, SCR triggering methods- R, RC, UJT triggering (using pulse Transformer), PUT, SUS, SBS triggering methods. SCR Turn off method - Class A, Class B, Class C, Class D, Class E, & Class F, SCR protection circuits	06
3	**Single & Three Phase Controlled Rectifier** 1 Φ Half Wave, Full Wave and semi controlled Rectifier, 3 Φ Half, Full and Semi Controlled rectifier with and without freewheeling diode. Study and Analysis for R, RL, RLE loads of load voltage and current. 1 Φ and 3 Φ dual converter.	07
4	**Inverters** Concept of inverter, types of inverters. Thyristorised inverters: series inverter, parallel inverter, IGBT based inverters: 1-phase half and full bridge inverter. 3-phase bridge inverter (120 and 180 mode of conduction) Voltage control of 1-phase and 3-phase inverter, harmonic reduction techniques	07
5	**Choppers** IGBT based Choppers: Step up and Step down chopper, Type A, Type B, Type C, Type D and type E choppers, voltage control techniques of choppers (TRC). Case Study: DC to DC converter in Solar System	06
6	**Applications** High frequency heating: Induction Heating, Electric welding: Introduction, Resistance welding, energy storage welding. Ultrasonic wave generation, AC voltage stabilizer, UPS - basic configuration and types. Electric Vehicle charging system	06

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz

5. Solve home assignments
6. Question paper will be based on all six units covering of theory , derivations and numericals.

Sr. No.	Reference Books
1	P.C. Sen, "Power Electronics", 1st Edition, Tata McGraw Hill.
2	M.D. Singh, K.B. Khanchandani, "Power Electronics", 2nd Edition, Tata- McGraw Hill
3	Mohan, Undeland, Riobbins, "Power Electronics" 3rd Edition, Wiley.
4	M.H. Rashid, "Power Electronics", TMH
5	Dubey, Doralda, Joshi,Sinha, "Thyristorised Power Controllers", New Age International Edition.
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

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<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 311P</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Power Electronics (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">EE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Electronics Circuit Design, Analog Electronics</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course contains power processing electronic circuits like controlled rectifiers, AC voltage controllers, DC-DC converters and inverters. Course introduces the basics of power semiconductor devices like SCRs, power BJTs, IGBTs and MOSFETs. The analysis of power circuits presented in detail along with the waveforms and control techniques</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Explain the Difference between power devices and low power devices.
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6. Demonstrate and validate power electronics circuits in the laboratory</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	3	3							1
CO 2	3	2	3	3	3							1
CO 3	3	2	3	2	3							1
CO 4	3	2	3	3	3							1
CO 5	2	2	3	2	3							1
CO 6	3	2	3	3	3							2

Level of Mapping as: Low 1, Moderate 2, High 3

	List of Practical	Hours
1	VI Characteristics of SCR.	**2**
2	Single phase Half wave controlled rectifier.	**2**
3	Single phase full wave controlled rectifier.	**2**
4	Single phase Bridge Full controlled rectifier.	**2**
5	SCR Triggering Circuits.	**2**
6	SCR Commutation Circuits.	**2**
7	3 Phase controlled rectifier.	**2**
8	Cyclo-converter circuit	**2**
9	Step down chopper.	**2**
10	Step up chopper.	**2**
11	Series inverter.	**2**
12	Parallel inverter.	**2**
13	Bridge inverter.	**2**

General Instructions:

1. Minimum 8 practical should be carried out based on above list or syllabus.
2. Batch wise practical are to be conducted. The number of students per batch should be as per the practical batches.

Sr. No.	**Reference Books**

1	P.C. Sen, "Power Electronics", 1st Edition, Tata McGraw Hill.
2	M.D. Singh, K.B. Khanchandani, "Power Electronics", 2nd Edition, Tata- McGraw Hill
3	Mohan, Undeland, Riobbins, "Power Electronics" 3rd Edition, Wiley.
4	M.H. Rashid, "Power Electronics", TMH
5	Dubey, Doralda, Joshi,Sinha, "Thyristorised Power Controllers", New Age International Edition.
Sr. No.	**Important web references**
1	https://swayam.gov.in/
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<tr><td>Course Code</td><td colspan="5">PCC 312</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Microcontrollers (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>--</td><td>02</td><td>05</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Digital Electronics, Programming Techniques</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with the study of architecture, device interfacing, assembly and C language programming for MCS-51, PIC microcontrollers. After learning this course students will be able to develop microcontroller based systems</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Discuss the fundamentals of microprocessors and microcontrollers
2. Explain the architecture of MCS 51 family
3. Illustrate the assembly language instructions and write assembly language programs
4. Illustrate C language programming for 8051 microcontroller
5. Describe interfacing and device programming
6. Discuss the architecture and programming for PIC microcontrollers</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Compare between microprocessors and microcontrollers
2. Describe the architectural features of 8051 microcontroller
3. Develop programs in assembly for 8051 microcontroller
4. Develop programs in C language for 8051 microcontroller
5. Interface the devices to microcontroller and write program to control the devices
6. Describe architecture of PIC microcontrollers and develop programs</td></tr>
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	2	2	3							2
CO 2	3	2	3	2	3							1
CO 3	3	2	3	2	3							2
CO 4	3	3	3	3	3							3
CO 5	3	3	3	3	3							3
CO 6	3		2	1	3							2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Fundamentals of Microcontrollers** Evolution of microprocessors & microcontrollers, microprocessors v/s microcontrollers 8/16/32 bit processors & controllers, CISC v/s RISC architectures, registers, memory & types of memory, bus, interrupts	07
2	**MCS-51 Microcontroller family** Introduction to MCS-51 architecture, 8051 microcontroller hardware, Input /output pins, external memory, register files, counters and timers, interrupts, serial communication, development tools IDE	06
3	**Instruction set and assembly language programming** Addressing modes, instruction set of 8051 microcontroller, assembly language programs	07
4	**Embedded C programming** Comparison of assembly and embedded c language programming, data types, variables, operators, storage classes, arrays, strings, C language programming for 8051 microcontroller	07
5	**MCS-51 Microcontroller interfacing and programming** Interfacing of LEDs, DC motors, stepper motors, buzzers, switches, matrix keyboards, seven segment displays, LCD displays, ADC, DAC, relays, thumbwheel , interfacing I2C,SPI bus devices,RS232	06
6	**Introduction to other microcontroller families** PIC 16F8XX microcontroller family, Arduino microcontrollers, ARM microcontrollers, Raspberry Pi microcontrollers.	06

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz
5. Solve home assignments
6. In End Semester Examination for question paper setting 60 % weightage should be given for programming and interfacing part.

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Sr. No.	Reference Books
1	Kenneth Ayala, "The 8051 Microcontroller Architecture, programming and Applications" Penram Intrnational
2	Muhammad Ali Mazidi, "The 8051 Microcontroller and Embedded systems" Pearson Education Asia LPE
3	Ajay Deshmukh, " Microcontrollers: Theory and applications ", Tata McGraw hill edition
4	Microchip PIC 16F877 family Microcontrollers Data sheet
5	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets
6	Mike Predcko "8051 Microcontrollers programming and practice"
7	John B. Peatman, "Design with PIC Microcontrollers " Pearson Education Asia. LPE
8	Microchip PIC 16F8XX family Microcontrollers Data sheet
9	ARM architecture reference manual
10	Arduino microcontroller manual
Sr. No.	**Important web references**
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<tr><td>Course Code</td><td colspan="5">PCC312P</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Microcontrollers (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>--</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">EE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Digital Electronics, Programming Techniques</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with the study of architecture, device interfacing, assembly and C language programming for MCS-51, PIC microcontrollers. After learning this course students will be able to develop microcontroller based systems</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Discuss the fundamentals of microprocessors and microcontrollers
2. Explain the architecture of MCS 51 family
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	2	2	3							2
CO 2	3	2	3	2	3							1
CO 3	3	2	3	2	3							2
CO 4	3	3	3	3	3							3
CO 5	3	3	3	3	3							3
CO 6	3		2	1	3							2

Level of Mapping as: Low 1, Moderate 2, High 3

	List of Experiments	Hours
1	Bit handling operations	**2**
2	Serial communication using assembly and embedded C language	**2**
3	Programming 7 segment displays using assembly and embedded C language	**2**
4	Programming LCD displays using assembly and embedded C language	**2**
5	Programming DC motor using assembly and embedded C language	**2**
6	Programming geared motor using assembly and embedded C language	**2**
7	Programming stepper motor using assembly and embedded C language	**2**
8	Traffic light control system using assembly and embedded C language	**2**
9	Programming timer and counter using assembly and embedded C language	**2**
10	Relay interfacing and programming in assembly and embedded C	**2**
11	Buzzer interfacing and programming in assembly and embedded C	**2**
12	Programming ADC/ DAC using assembly and C language	**2**

General Instructions:

1. Minimum 8 experiments should be carried out based on above list or syllabus.
2. Batch wise practical are to be conducted. The number of students per batch should be as per the practical batches.

Sr. No.	**Reference Books**

1	Kenneth Ayala, "The 8051 Microcontroller Architecture, programming and Applications" Penram Intrnational
2	Muhammad Ali Mazidi, "The 8051 Microcontroller and Embedded systems" Pearson Education Asia LPE
3	Ajay Deshmukh, " Microcontrollers: Theory and applications ", Tata McGraw hill edition
4	Microchip PIC 16F877 family Microcontrollers Data sheet
5	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets
6	Mike Predcko "8051 Microcontrollers programming and practice"
7	John B. Peatman, "Design with PIC Microcontrollers " Pearson Education Asia. LPE
8	Microchip PIC 16F8XX family Microcontrollers Data sheet
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<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Digital Signal Processing (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>--</td><td>--</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE: 30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Digital Electronics , Programming Techniques , Signals & systems</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course covers theory and methods for digital signal processing including basic principles, relationship between DTFT and DFT, Discrete Fourier transforms and z-transforms, computation of DFT & IDFT, FFT algorithms and its implementation, impulse response, finite and infinite impulse response, digital filter design and implementation, DSP applications in different fields.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Expalin DFT and its properties, IDFT, FFT algorithms, circular convolution, correlation

2. Discuss different algorithms to find linear convolution, DFT and IDFT

3. Analyze FIR filter design using different methods

4. Analyze study FIR filter design using different methods

5. Explain adaptive signal processing and adaptive filters

6. Study applications of Digital Signal Processing in different fields</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Calculate DFT, IDFT and convolution

2. Apply different algorithms for linear convolution and DFT, IDFT

3. Design FIR filters using different techniques

4. Design IIR filters using different methods

5. Describe adaptive signal processing and adaptive filter models

6. Illustrate the role of DSP in different areas</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	3	3							2
CO 2	3	2	3	3	3							1
CO 3	3	2	3	2	3							1
CO 4	3	2	3	3	3							1
CO 5	2	2	3	2	3							1
CO 6	3	2	3	3	3							2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Introduction to DSP System** DSP, Basic elements of DSP, Advantages of Digital Signal Processing, Comparison between Digital and Analog Signal Processing, Applications	07
2	**Discrete Fourier Transform (DFT)** DFT, Properties of DFT, Circular Convolution and Circular Co-relation using DFT and IDFT , Linear Convolution using Circular Convolution, Fast Convolution. Overlap Save and Overlap add algorithm. Relationship between DTFT, DFT and ZT. FFT Algorithms – Radix 2: DIT-FFT and Radix 2: DIF.- FFT	06
3	**FIR Filter Design** FIR Filter, Characteristics of FIR Filters, Properties of FIR Filters, FIR filter design using Windowing Technique :Rectangular, Hamming , Kaiser Window, FIR filter Design using Frequency Sampling Technique, FIR filter realization- Direct Form I and Direct Form II, Cascade and Parallel form realization	07
4	**IIR Filter Design** Introduction to IIR Filters, IIR Filter Design using Impulse Invariant method and Bilinear Transformation method, Butterworth Approximation, Chebyshev filters design, IIR filter realization- Direct form I and Direct form II, Cascade and parallel realization.	07
5	**Adaptive Filter** Introduction to adaptive filters, Applications of adaptive filters, Adaptive direct form FIR filter and its use, Adaptive algorithm: Least Mean Square (LMS) algorithm	06
6	**Application of Digital Signal Processing** Mobile communication, Bio-medical Engineering, image processing, Acoustic Noise Canceller, Dynamic range compression, LPC analysis and synthesis, SSB modulation, Radar tracking & implementation ,Study of architecture of TMS 320C6XXX processor	06

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz

5. Solve home assignments
6. Question paper will be based on all six units covering of theory , derivations and numericals.

Sr. No.	Reference Books
1	John G Prokis , "Digital Signal Processing ,Principles, Algorithms and Application", PHI
2	S.K.Mitra, "Digital Signal Processing", TMH
3	Avtar Singh, S. Srinivasan, "Digital Signal Processing Implementation using DSP, Microprocessors with examples from TMS 320C6XXX", Thomas Publication
4	A.V.Oppenheins and R.W. Schalfer , "Discrete Time Signal Processing", PHI
5	S. Salivahanam, A Vallavaraj, C. Guanapriya, "Digital Signal Processing",TMH
6	Raghuveer M. Rao and Ajit S. Boperdikar , "Wavelet Transforms – Introduction to theory and applications", Pearson Education.
7	Smith, "Scientist and Engg. Guide on Digital Signal Processing"
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

Year, Program, Semester	Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester V				
Course Code	PCC314				
Course Category	Professional Core course				
Course title	**Advanced Programming Techniques (Theory)**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	02	--	02	04	03
Evaluation Scheme	**ISE:30**			**ESE: 70**	**Total=100**
Pre-requisites (if any)	Digital Electronics , Programming Techniques				
Course Rationale	This course deals with programming using Python language				
Course Objectives	1. Illustrate Python installation 2. Discuss numeric and string operations 3. Illustrate lists and dictionaries 4. Explain tuples and file operations 5. Explain statements and functions 6. Discuss modules and packages				
Course Outcomes	1. Demonstrate Python installation 2. Experiment on numeric types and strings 3. Demonstrate lists and dictionaries operations 4. Demonstrate tuples and file operations 5. Use statements and functions 6. Experiment modules and packages				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	3	1	3							2
CO 2	3	1	3	1	3							2
CO 3	3	1	3	1	3							2
CO 4	3	1	3	1	3							2
CO 5	3	1	3	1	3							2
CO 6	3	1	3	1	3							2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Introduction and installation of python** Introduction and advantages, Python versions, installation on different OS like Windows MacOS, Ubuntu Linux, OpenIDLE , Interactive window, python shell, editor, operators , variables in python,	07
2	**Numeric types and strings** Numeric types: Basics, literals, variables, expressions, numeric display formats, comparison, division, integer precision, complex numbers, Hex-octal-binary numbers and conversions, decimal, fractional, sets, Booleans. **Strings:** Basics, string literals, basic string operations- indexing and slicing, string methods, string formatting expressions	06
3	**Lists and dictionaries** Basics of list, list operations, list iterations, dictionaries and operations in dictionaries	07
4	**Tuples and file operations** Tuples, File operations	07
5	**Statements and functions** If, if-else, while loop, for loop, pass, continue, break, loop else, loop coding techniques. **Functions:** Coding functions, calls, polymorphism, recursive functions	06
6	**Modules and packages** Modules, search path, module creation, module uses, module namespaces, module reloading, **Package:** package basics, package imports, search path settings	06

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz
5. Solve home assignments
6. Question paper will be based on all six units.

Sr. No.	Reference Books
1	Mark Lutz, " Learning Python ", O'Reilly media
2	Miles, " Begin to code with Python", Pearson
3	Anurag Gupta, G. Biswas, "Python Programming", TMH
4	Mark Lutz, " Learning Python ", O'Reilly media
5	Qingkai Kong, Timmy Siauw, Bayen , " Python programming and numerical methods- A guide for engineers and scientists", Elsevier
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<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Advanced Programming Techniques (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">EE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Digital Electronics , Programming Techniques</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with programming using Python language</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Illustrate Python installation
2. Discuss numeric and string operations
3. Illustrate lists and dictionaries
4. Explain tuples and file operations
5. Explain statements and functions
6. Discuss modules and packages</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Demonstrate Python installation
2. Experiment on numeric types and strings
3. Demonstrate lists and dictionaries operations
4. Demonstrate tuples and file operations
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	3	1	3							2
CO 2	3	1	3	1	3							2
CO 3	3	1	3	1	3							2
CO 4	3	1	3	1	3							2
CO 5	3	1	3	1	3							2
CO 6	3	1	3	1	3							2

Level of Mapping as: Low 1, Moderate 2, High 3

	List of Experiments	**Hours**
1	Write a program to demonstrate basic data types in Python	**2**
2	Write a program to perform different arithmetic operations	**2**
3	Write a program to create, concatenate and print a string and accessing substring from a given string.	**2**
4	Write a python script to print the current date	**2**
5	Write a python program to create, append and remove lists in python.	**2**
6	Write a program to check odd /even number	**2**
7	Write a program to demonstrate list and tupple in python	**2**
8	Write a program to demonstrate working with dictionaries in python	**2**
9	Write a python program to find largest of three numbers	**2**
10	Write a python program to convert temperature to and from Celsius to fahrenheit	**2**
11	Write a python program to construct the given pattern using nested for loop	**2**
12	Write a python program to print prim numbers less than 50	**2**
13	Write a python program to find factorial of a number using recursion	**2**
14	Write a python program to define a module to find Fibonacci Numbers and import the module to another program	**2**
15	Write a python program to define a module and import a specific function in that module to another program	**2**
16	Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order	**2**

17	Write a Python class to convert an integer to a roman numeral.	**2**
18	Write a program to find area of given structure like triangle, circle, equilateral triangle etc.	**2**

General Instructions:

1. Minimum 8 experiments should be carried out based on above list or syllabus.
2. Batch wise experiments are to be conducted. The number of students per batch should be as per the practical batches.

Sr. No.	**Reference Books**
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<tr><td>Course Code</td><td colspan="5">PBL311</td></tr>
<tr><td>Course Category</td><td colspan="5">Project based learning</td></tr>
<tr><td>Course title</td><td colspan="5">Mini project-I</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">IE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Electronic circuit design, Analog Electronics, Digital Electronics, Microcontrollers,</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with inculcating students skills for design, development, simulation, programming of electronics / software based systems to solve societal/ industrial problems.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Illustrate basic steps in electronic system design
2. Survey the problem and find technological solution
3. Design small scale electronics systems to accomplish task
4. Construct circuit models and simulate
5. Work in team to complete the task
6. Manage project in given time</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Illustrate fundamental stages in development of electronics engineering projects
2. Apply engineering knowledge for providing technological solutions
3. Simulate and design the circuits
4. Work in team environment
5. Write report , consider ethical issues in report writing / project management and express technical details
6. Consider social, environmental, industrial issues</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	2	3					1	2	2
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CO 4	3	3	3	2	3					1	2	2
CO 5	3	3	3	2	3	2		3		2	2	2
CO 6	2	2	1	2	2	2	1	1	3	1	2	2

Level of Mapping as: Low 1, Moderate 2, High 3

	Curriculum Content	**Hours**
1	**Curriculum Content** Group size and activities: 1) Mini project group size should not exceed three students per every group. 2) Project idea should be proposed and finalized in consultation with guide. 3) Proposed weekly plan of the project should be finalized with guide. 4) Project work should be carried out in following steps a) Selection of project & problem definition. b) Paper design (Circuit design and flow chart of software) c) Simulation if required. d) Hardware implementation e) Software implementation (if required) f) Testing and calibration g) Report writing 5) Compulsory submission of mini project report by each group is a must. 6) Projects of two or more groups should not be same. 7) Seminar must be delivered after completion of project by each group preferably by using power point presentation. 8) Mini-project report must be submitted before/at the time of viva-voce . Project Contents: 1) It should consists of hardware part and software part is optional. 2) Design of PCB by using suitable CAD tool, simulation if necessary, component mounting, soldering, testing , result analysis should be done by group. 3) Design and development of cabinet should be done for the project. **Guidelines for mini-project selection** Parameter monitoring, parameter / system controlling applications, data acquisition systems, microcontroller based systems, digital design, communication projects, VLSI based project, power supply and batteries	

General Instructions:

1. A report should be submitted by students to he department in the given format.

Sr. No.	**Reference Books**

1	Articles from reputed journals, magazines, websites, real world problems, case studies
Sr. No.	**Important web references**
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<tr><td>Course Code</td><td colspan="5">AEC311</td></tr>
<tr><td>Course Category</td><td colspan="5">Ability Enhancement Course</td></tr>
<tr><td>Course title</td><td colspan="5">Introduction to Foreign Language</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>01</td><td>-</td><td>-</td><td>01</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3"></td><td>IE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">--</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course provides a competitive edge for engineering graduates in their career choices. They will be able to communicate in a second language. The course enhances listening, reading skills and memory. Our graduates may be able to participate more effectively and responsibly in a multi-cultural world if they know another foreign language in addition to the English</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Help students to understand basics and deepen their knowledge in a chosen foreign language

2. Guide them to communicate and translate in the chosen foreign languages

3. Help them describe, narrate, and ask/answer questions in the foreign language in the present time about a variety of topics related to family, daily activities, eating, and traveling

4. Comprehend the foreign language with sufficient ability to grasp the main idea and some supporting details in short conversations (spontaneous or recorded) that pertain to the topics mentioned above

5. Explain how to write sentences and short paragraphs on familiar topics relating to personal interests and practical needs

6. Narrate on how the foreign language functions with awareness and understanding of the language culture</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Learn alphabets and acquire knowledge of basic grammar of the foreign language, common words and phrases therein

2. Learn to read the simple texts in foreign language

3. Speak a little using the greetings, well wishes etc. in Foreign Language

4. Count numbers, answer to the questions like, what is your name, surname, tell age, and can initiate little communication in Foreign</td></tr>
</table>

	Language 5. Translate both verbally and written, simple sentences in the foreign language 6. Achieve institute's mission with respect to global education and foreign language education

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1										2		
CO 2										1		
CO 3										2		
CO 4										2		
CO 5										2		
CO 6										3		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	General Information on Basic Grammar of the foreign language, Introduction to alphabets	**2**
2	Gender of Noun, Number of Noun, Pronouns, Adjectives, Verbs and their usage in simple sentences, Numbers (up to 10), Simple Greetings in foreign language	**2**
3	General Questions in foreign language, like What is your name/surname? Who/What is this? etc.	2
4	Simple narration about self/family/friend/University in foreign language chosen for studies. Practicing the learnt topics in the class itself.	2
5	Formation of simple sentences using Parts of Speech, Information on Cases, One or Two simple lessons from any book.	2
6	Basic information on Country & Culture of language under study.	2

General Instructions:
The assessment shall be done based on the 50 marks written examination.

Sr. No.	Reference Books
1	Based on the language chosen, the suitable text and reference books may be selected.
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="4">T.Y. B.Tech (Electronics and Telecommunication Engineering) , Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="4">MAC311</td></tr>
<tr><td>Course Category</td><td colspan="4">Mandatory Audit Course</td></tr>
<tr><td>Course title</td><td colspan="4">Aptitude Enhancement Course II</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td>02</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="4">IE at Course in charge end</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="4">Basic Mathematical Concepts</td></tr>
<tr><td>Course Objectives</td><td colspan="4">The Course is aimed to-
1. Understand key concepts such as HCF, LCM, decimal fractions, square roots, and cube roots, to build a strong base for problem-solving.
2. Enhance skills in simplifying complex mathematical expressions and perform efficient computations using the principles of simplification, surds, and logarithms.
3. Learn to solve practical problems involving percentages, profit-loss scenarios, and partnership calculations.
4. Grasp the principles and formulas used in solving problems related to time and work, pipes and cisterns, and time and distance.
5. Sharpen the ability to analyze and solve problems involving analogies, classifications, series, and coding-decoding sequences.
6. Develop problem-solving skills related to blood relations, direction sense tests, puzzles, and logical Venn diagrams.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">Upon completion of this course, student should be able to –
1. Demonstrate an ability to solve problems related to number systems, including HCF, LCM, decimal fractions, square roots, and cube roots, accurately.
2. Solve complex problems involving simplification, surds, and logarithms more efficiently, and improve calculation speed and accuracy.
3. Apply knowledge of percentages, profit and loss, ratio and proportion, and partnership to real-life scenarios and mathematical problems.
4. Solve time, work, and distance-related problems, including pipes and cisterns, with a clear understanding of concepts and application of formulas.
5. Solve questions involving analogies, classifications, series completions, and coding-decoding with greater confidence.
6. Demonstrate enhanced ability to solve puzzles, directional sense, blood relation, and logical Venn diagram problems with precision and logical deduction.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	2									1
CO 2	3	1	2									1
CO 3	3	1	2									1
CO 4	3	1	2									1
CO5	1		1									1
CO6	1		1									1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Quantitative Aptitude 1** Number System, H.C.F. and L.C.M. of Numbers, Decimal Fractions, Simplification, square Roots and Cube Roots.	2
II	**Quantitative Aptitude 2** Average, Problems on Numbers, Problems on Ages, Surds and Indices, Logarithms.	2
III	**Quantitative Aptitude 3** Percentage, Profit and Loss, Ratio and Proportion, Partnership.	2
IV	**Quantitative Aptitude 4** Chain Rule, Pipes and Cisterns, Time and Work, Time and Distance.	2
V	**Logical Reasoning 1** Analogy, classification, series completion, coding and decoding.	2
VI	**Logical Reasoning 2** Blood relation, Puzzle test, direction sense test, logical Venn diagram.	2

General Instructions:
Each Student has to write at least 6 assignments on entire syllabus.

Reference Books

i) Dr. R S Aggarwal — Quantitative aptitude, S. Chand Publication.

ii) R V Praveen — Quantitative aptitude and logical reasoning, 2nd Edition, PHI Publication.

Assessment

Assessment will be done by Course Teacher. MCQ Test can be conducted based on the syllabus.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">ESC321</td></tr>
<tr><td>Course Category</td><td colspan="5">Engineering science course</td></tr>
<tr><td>Course title</td><td colspan="5">Antenna and wave propagation</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td>05</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE: 30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Engineering Physics, Electromagnetic Fields</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Antennas are an indispensable part of wireless communication systems. Wave propagation effects play a crucial role in wireless systems, although they are often overlooked. In practice, designing a working system such as mobile phone networks, Wi-Fi, RFID, Embedded systems, Satellite communication, Radars, GPS etc. requires a good understanding of these components. This course teaches the fundamentals of antenna and wave propagation and shows the application in practical examples. The course covers the theory of radiation, fundamental antenna parameters and concepts, various types of antennas, arrays, and wave propagation effects.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Explain the basic terminology and concepts of Antennas
2. Estimate the electric and magnetic fields from various wire antennas
3. Compare and contrast the working of patch antenna and their specialties
4. Discuss working of antenna arrays
5. Discuss working of aperture antennas
6. Explain wave propagation and modes</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Describe the radiation mechanism of antenna and calculate antenna parameters
2. Identify and analyze various wire antennas with applications.
3. Design and analyze Microstrip Patch Antenna
4. Analyze array of antennas and their applications
5. Design and analyze aperture antennas for different applications
6. Evaluate effect of wave propagation on communication systems</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	1							1
CO 2	3	2	2	1	1							1
CO 3	3	2	2	1	1							1
CO 4	3	2	2	1	1							1
CO 5	3	2	2	1	1							1
CO 6	3	2	2	1	1							1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Antennas and Fundamental Parameters** Introduction, Radiation Mechanism, Radiation Pattern, Basic Antenna Parameters: Beam Width, Beam Area, Directivity, Radiation Intensity, Beam Efficiency, Gain, Radiation Resistance, Front to Back Ratio, Antenna Aperture, Effective Height, Bandwidth, Reflection Coefficient , Polarization, The Radio Communication Link: Friis Transmission Equation.	07
2	**Wire antennas** Infinitesimal Dipole, Small Dipole, Half-Wavelength Dipole, Ground Effect, Monopole	06
3	**Microstrip Patch Antenna** Introduction, Regular Shape MSAs (Rectangular, Circular, Equilateral, Triangular), Feeding Techniques, Transmission Line Model, Design of Rectangular MSA, Mobile Phone Antenna	07
4	**Antenna Arrays** Linear arrays, Array of Two Isotropic Point Sources, Linear Arrays of N Elements, Broadside and End-fire Array, Principle of Pattern Multiplication, Yagi Uda Antenna, Log Periodic Antenna.	07
5	**Aperture Antennas** Horn Antennas: E-Plane Sectoral Horn, H-Plane Sectoral Horn, Pyramidal Horn, Conical Horn, Reflector Antennas: Introduction, Parabolic Reflector, Parabolic Reflector Feeding Techniques.	06
6	**Wave Propagation** Structure of Atmosphere, Modes of Wave Propagation: Ground Wave, Sky Wave Space Wave Propagation, Virtual Height, Maximum Usable Frequency, Critical Frequency, Angle of Incidence, Lowest Usable Frequency, Skip Distance.	06

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz
5. Solve home assignments
6. Question paper will be based on all six units covering of theory , derivations and numericals.

Sr. No.	Reference Books
1	John. D. Kraus, "Antennas & Wave Propagation", Fifth Edition, Tata McGraw Hill.
2	C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley.
3	Girish Kumar, K.P. Ray, "Broadband Microstrip Antennas", Artech House Publishers

4	K. D. Prasad, "Antenna and Wave Propagation", Satya Prakashan.
5	G. S. N. Raju, "Antennas and Wave Propagation", Pearson Education.
6	E.C. Jordan & K.G. Balmain, "Electromagnetic waves & Radiating Systems", Prentice Hall, India
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">ESC321P</td></tr>
<tr><td>Course Category</td><td colspan="5">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Antenna and Wave propagation (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>--</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">IE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Engineering Physics, Electromagnetic Fields</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Antennas are an indispensable part of wireless communication systems. Wave propagation effects play a crucial role in wireless systems, although they are often overlooked. In practice, designing a working system such as mobile phone networks, Wi-Fi, RFID, Embedded systems, Satellite communication, Radars, GPS etc. requires a good understanding of these components. This course teaches the fundamentals of antenna and wave propagation and shows the application in practical examples. The course covers the theory of radiation, fundamental antenna parameters and concepts, various types of antennas, arrays, and wave propagation effects.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Explain the basic terminology and concepts of Antennas
2. Estimate the electric and magnetic fields from various wire antennas
3. Compare and contrast the working of patch antenna and their specialties
4. Discuss working of antenna arrays
5. Discuss working of aperture antennas
6. Explain wave propagation and modes</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Describe the radiation mechanism of antenna and calculate antenna parameters
2. Identify and analyze various wire antennas with applications.
3. Design and analyze Microstrip Patch Antenna
4. Analyze array of antennas and their applications
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</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	1							1
CO 2	3	2	2	1	1							1
CO 3	3	2	2	1	1							1
CO 4	3	2	2	1	1							1
CO 5	3	2	2	1	1							1
CO 6	3	2	2	1	1							1

Level of Mapping as: Low 1, Moderate 2, High 3

	List of experiments	Hours
1	Study of antenna trainer kit.	**2**
2	Measurement of radiation pattern of Simple λ/2 Dipole Antenna.	**2**
3	Study of monopole antenna	**2**
4	Measurement of radiation pattern of folded Dipole Antenna	**2**
5	Measurement of radiation pattern of Loop antenna.	**2**
6	Study of Helical Antenna	**2**
7	Measurement of radiation pattern of 3 element Yagi-UDA antenna	**2**
8	Measurement of radiation pattern of 5 element Yagi-UDA antenna	**2**
9	Measurement of radiation pattern of 7 element Yagi-UDA antenna	**2**
10	Measurement of radiation pattern of Log Periodic Antenna	**2**
11	Measurement of radiation pattern λ/2 Phase Array	**2**
12	Study of broadside array antenna	**2**
13	Study of end fire array antenna	**2**
14	Any simulator based practical based on the above syllabus	**2**

General Instructions:

1. Minimum 8 experiments should be carried out based on above list or syllabus.
2. Batch wise experiments are to be conducted. The number of students per batch should be as per the practical batches.

Sr. No.	Reference Books
1	John. D. Kraus, "Antennas & Wave Propagation", Fifth Edition, Tata McGraw Hill.
2	C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley.
3	K. D. Prasad, "Antenna and Wave Propagation", Satya Prakashan.
4	Girish Kumar, K.P. Ray, "Broadband Microstrip Antennas", Artech House Publishers
5	G. S. N. Raju, "Antennas and Wave Propagation", Pearson Education.
6	E.C. Jordan & K.G. Balmain, "Electromagnetic waves & Radiating Systems", Prentice Hall, India
Sr. No.	**Important web references**
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2	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 321</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Control Systems (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>01</td><td>-</td><td>04</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE:70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Engineering Mathematics 3, Microcontrollers, Network Theory</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Control Systems is the study of the analysis and regulation of the output behaviors of dynamical systems subject to input signals. This subject will develop the theory, concepts tools used in engineering disciplines such as mechanical, electrical, engineering. The knowledge acquired by the students will help them to design control system.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. To study mathematical modeling of physical system
2. To study and analyze time domain and frequency domain methods
3. To study stability of linear control system using different methods</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Describe the basic principles, types of control systems and I/P –O/P relationship by using mathematical model and transfer function
2. Understand and analyze parameters of a feedback control system and its transient behavior
3. Evaluate the stability of a system by using different stability criteria
4. Plot the Root locus and Nyquist plot, for a given control system for stability analysis
5. Plot the Bode for a given control system for stability analysis
6. Analyze performance of control system by using state space</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	1							1
CO 2	3	2	2	1	1							1
CO 3	3	2	2	1	1							1
CO 4	3	2	2	1	1							1
CO 5	3	2	2	1	1							1
CO 6	3	2	2	1	1							1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**System Modeling**: Introduction to control system, Types of control system, Laplace transform review, Transfer function of electrical, mechanical, thermal, hydraulic system, Electrical circuits analogs, Block dia. Representation and reduction, types of feedback systems, signal flow graph , Mason's gain rule, SFG	07
2	**Time domain Response** Time domain Response of first and second order system, Types of standard inputs, response with additional pole and zeros, steady state error for unity feedback system, static error constants and systems type, steady state error specifications, Concept of stability for linear systems, Absolute and relative stability, Routh stability criterion and its application in special cases.	06
3	**Frequency Domain Techniques** Frequency domain specification, Correlation between time and Frequency domain specifications, Bode plot, Nyquist criterion, stability, gain margin, phase margin by Nyquist diagram and bode plot, Effect of gain variation and addition of poles and zeros on Bode plot	07
4	**Modelling in Time domain** state-space representation, Applying the state- space representation, converting the transfer function to state- space, converting from state -space to transfer function.	07
5	**Root Locus Techniques** Definition of root locus, Rules for plotting root loci, Root contour, stability analysis using root locus, effect of addition of pole and zero.	06
6	**Feedback control systems** Feedback control system characteristics, error analysis, P , PI, PD and PID Controllers. Digital control system, Introduction, Transfer function of digital control system.	06

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work / MATLAB based simulation
3. Site visit
4. Solve technical quiz
5. Solve home assignments
6. Question paper will be based on all six units covering of theory , derivations and numericals.

Sr. No.	Reference Books
1	"Control System Engineering", Norman S. Nise,John willey and Sons, 6th Edition, 2015.
2	"Control System Engineering",I.J. Nagrath and M. Gopal,New age International publication, 5th Edition, 2014.
3	"Automatic Control Systems",Kuo B.C.,Prentice-Hall of India Pvt.Ltd.New Delhi.6th edition.1991
4	"Modern Control Engineering", Katsuhiko Ogata,Prentice Hall of India Pvt Ltd, 5th edition.
5	"Automatic Control System", Benjamin C. Kuo, Prentice Hall of India Pvt Ltd, Wiley publication, 9th edition
6	"Control Systems-Principles and Design", M.Gopal, Tata McGraw-Hill Education Pvt. Ltd, 4th edition, 2014.
7	"Control System Engineering",R.Anandanatarajan,P.Ramesh Babu,Second Edition,Scitech publications Pvt.(India)Ltd.2008
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC321T</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Control Systems (Tutorial)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>01</td><td>-</td><td>01</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">IE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Engineering Mathematics 3, Microcontrollers, Network Theory</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Control Systems is the study of the analysis and regulation of the output behaviors of dynamical systems subject to input signals. This subject will develop the theory, concepts tools used in engineering disciplines such as mechanical, electrical, engineering. The knowledge acquired by the students will help them to design control system.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. To study mathematical modeling of physical system
2. To study and analyze time domain and frequency domain methods
3. To study stability of linear control system using different methods</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Describe the basic principles, types of control systems and I/P –O/P relationship by using mathematical model and transfer function
2. Understand and analyze parameters of a feedback control system and its transient behavior
3. Evaluate the stability of a system by using different stability criteria
4. Plot the Root locus and Nyquist plot, for a given control system for stability analysis
5. Plot the Bode for a given control system for stability analysis
6. Analyze performance of control system by using state space</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	1							1
CO 2	3	2	2	1	1							1
CO 3	3	2	2	1	1							1
CO 4	3	2	2	1	1							1
CO 5	3	2	2	1	1							1
CO 6	3	2	2	1	1							1

Level of Mapping as: Low 1, Moderate 2, High 3

	Course Content	**Hours**
1		

General Instructions:

1. Minimum 8 tutorials should be carried out based on above list or syllabus.
2. Batch wise tutorials are to be conducted. The number of students per batch should be as per the practical batches.
3. Students must be encouraged to solve engineering mathematics problems using different mathematical software's like MATLAB, Scilab etc.

Sr. No.	**Reference Books**
1	"Control System Engineering", Norman S. Nise,John willey and Sons, 6th Edition, 2015.
2	"Control System Engineering",I.J. Nagrath and M. Gopal,New age International publication, 5th Edition, 2014.
3	"Automatic Control Systems",Kuo B.C.,Prentice-Hall of India Pvt.Ltd.New Delhi.6th edition.1991
4	"Modern Control Engineering", Katsuhiko Ogata,Prentice Hall of India Pvt Ltd, 5th edition.
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6	"Control Systems-Principles and Design", M.Gopal, Tata McGraw-Hill Education Pvt. Ltd, 4th edition, 2014.
7	"Control System Engineering",R. Ananda natarajan,P. Ramesh Babu,Second Edition,Scitech publications Pvt.(India)Ltd.2008
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<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC322</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">VLSI Design (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td>05</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Digital Electronics , Programming Techniques</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with understanding working of MOS transistors, MOS transistor based circuits, chip manufacturing and chip design, programming and prototyping.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Illustrate the construction, characteristics of MOS transistors
2. Discuss CMOS IC manufacturing process
3. Illustrate Verilog and other HDLs
4. Learn Hardware Description Language
5. Develop Verilog codes to design various digital circuits
6. Familiarity with UVM (Universal Verification Methodology)</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Describe the structure, working principle and characteristics of MOS devices
2. Explain CMOS IC fabrication technology & IC design flow.
3. Experiment using Verilog language and explain features of HDL
4. Develop Verilog code for different digital circuits
5. Describe construction and features of programmable logic devices
6. Describe the UVM (Universal Verification Methodology)</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3		2		3							1
CO 2	3	3	2	3	3							1
CO 3	3	3	2	3	2							2
CO 4	3	3	2	3	2							1
CO 5	3	1	2	3	2							1
CO 6	3	3	2	3	2							2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**MOS Devices** Introduction to MOS Technology, I – V Characteristics of NMOS and PMOS, Transfer Characteristics Of CMOS Inverter, Detailed analysis of CMOS inverter, Logic realization using nMOS and CMOS circuits, effect of parasitic elements.	07
2	**CMOS IC Fabrication and Layout** Basic CMOS Technology: Self aligned CMOS process, N well, P well, Twin tub, Layout of CMOS Inverter, CMOS Layout and Design rules. Silicon on Insulator technology, IC Design flow	06
3	**Introduction to Verilog** Abstraction levels, modules, port, declarations, registers, arrays, identifiers, parameters, arithmetic and logical operators, expressions, procedural statements, blocking and non-blocking statements, control statements, delays, memory modeling, VHDL V/s Verilog comparison	07
4	**Circuit Design using Verilog** Designing basic gates, combinational circuit, designing general purpose processor, datapath, ALU, encoder, decoder, comparator, adder, subtractor, multiplexer, de-multiplexer, tri-state drivers, PIPO, SIPO, sequential circuits	07
5	**Circuit Design Using CPLD & FPGA** Introduction, study of architecture of CPLDs and FPGAs. Function block architecture, input/output Block and interconnect, switch matrix, FPGA fabric. System on Chip architecture. Case study of FPGA and SoC	06
6	**Verification** UVM (Universal Verification Methodology), Need of UVM, UVM class hierarchy, UVM class categories,	06

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz
5. Solve home assignments
6. Question paper will be based on all six units.

Sr. No.	Reference Books
1	N. Weste and K. Eshranghian, "Principles of CMOS VLSI Design", Addison Wesley
2	Angsuman Sarkar, Swapnadip De, Ckandan Kumar Sarkar, "VLSI Design and EDA tools", Scitech
3	Amar Mukharjee, "Introduction to nMOS and cMOS VLSI systems design", Prentice Hall
4	Samir Palnitkar, "Verilog HDL, A guide to digital design and synthesis", Pearson
5	Stephen Brown and Zvonko, " Vranesic, Fundamaentals of Digital Logic with VHDL design", Tata McGraw Hill
6	BushnellAgrawal , "Essentials of Electronic Testing for digital memory and mixed signal VLSI circuits", Kulwar Academic Publisher
Sr. No.	**Important web references**
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2	https://nptel.ac.in/

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<tr><td>Course Code</td><td colspan="5">PCC322</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">VLSI Design (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">EE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Digital Electronics , Programming Techniques</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with understanding working of MOS transistors, MOS transistor based circuits, chip manufacturing and chip design, programming and prototyping.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Illustrate the construction, characteristics of MOS transistors
2. Discuss CMOS IC manufacturing process
3. Illustrate Verilog and other HDLs
4. Learn Hardware Description Language
5. Develop Verilog codes to design various digital circuits
6. Familiarity with UVM (Universal Verification Methodology)</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Describe the structure, working principle and characteristics of MOS devices
2. Explain CMOS IC fabrication technology & IC design flow.
3. Experiment using Verilog language and explain features of HDL
4. Develop Verilog code for different digital circuits
5. Describe construction and features of programmable logic devices
6. Describe the UVM (Universal Verification Methodology)</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3		2		3							1
CO 2	3	3	2	3	3							1
CO 3	3	3	2	3	2							2
CO 4	3	3	2	3	2							1
CO 5	3	1	2	3	2							1
CO 6	3	3	2	3	2							2

Level of Mapping as: Low 1, Moderate 2, High 3

	List of Experiments	**Hours**
1	Simulation, modeling and characteristics study of nMOS & pMOS transistors (Custom and semicustom)	**2**
2	Simulation, modeling and characteristics study of CMOS inverter circuitry (Custom and semicustom)	**2**
3	Design and implementation of gates and combinational logic in CPLD / FPGA	**2**
4	Design and implementation of adder in CPLD / FPGA	**2**
5	Design and implementation of subtractor in CPLD / FPGA	**2**
6	Design and implementation of ALU in CPLD / FPGA	**2**
7	Design and implementation of encoder in CPLD / FPGA	**2**
8	Design and implementation of decoder in CPLD / FPGA	**2**
9	Design and implementation of multiplexer in CPLD / FPGA	**2**
10	Design and implementation of demultiplexer in CPLD / FPGA	**2**
11	Design and implementation of comparator in CPLD / FPGA	**2**
12	Design and implementation of tristate driver in CPLD / FPGA	**2**
13	Design and implementation of Flip-Flops in CPLD / FPGA	**2**
14	Design and implementation of sequential circuits in CPLD / FPGA	**2**

General Instructions:

1. Minimum 8 experiments should be carried out based on above list or syllabus.
2. Batch wise experiments are to be conducted. The number of students per batch should be as per the practical batches.

Sr. No.	**Reference Books**
1	N. Weste and K. Eshranghian, "Principles of CMOS VLSI Design", Addison Wesley

2	Angsuman Sarkar, Swapnadip De, Ckandan Kumar Sarkar, "VLSI Design and EDA tools", Scitech
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4	Samir Palnitkar, "Verilog HDL, A guide to digital design and synthesis", Pearson
5	Stephen Brown and Zvonko, " Vranesic, Fundamaentals of Digital Logic with VHDL design", Tata McGraw Hill
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<tr><td>Course Code</td><td colspan="5">OE321-1</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course (Program Elective I)</td></tr>
<tr><td>Course title</td><td colspan="5">ARM and Embedded systems</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td>05</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE: 30</td><td colspan="2">ESE: 70</td><td>Total = 100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Digital Electronics , Programming Techniques , Microcontrollers</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with study of 32-bit ARM 7 architecture and understanding the fundamentals of Embedded systems</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Study and understand the architecture of ARM7TDMI family
2. Study assembly language instructions of ARM microcontroller
3. Write programs for ARM microcontroller in assembly
4. Understand the memory management techniques
5. To be familiar with embedded systems
6. Understand applications of embedded systems</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Discuss the architecture of ARM7TDMI microcontroller
2. Explain the instruction set of ARM microcontroller
3. Write programs in assembly and C language for ARM microcontroller family
4. Discuss the memory management scheme of ARM microcontroller
5. Compare the features of 8-bit, 16-bit and 32-bit microcontrollers
6. Illustrate the features and applications of embedded systems</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	2	2	3							2
CO 2	3	2	3	2	3							1
CO 3	3	2	3	2	3							2
CO 4	3	3	3	3	3							3
CO 5	3	3	3	3	3							3
CO 6	3		2	1	3							2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**INTRODUCTION TO ARM ARCHITECTURE** ARM7TDMI architecture, registers, interrupts, exception process, status registers processor modes, memory, memory mapped I/O, endianness	07
2	**ARM INSTRUCTION SET** ARM instruction set: Data processing instruction, Load, store, Branch, interrupt instruction, program status register instruction, loading constants, conditional execution	06
3	**THE THUMB INSTRUCTION SET** Entering thumb state, Thumb instruction set: Thumb register usage, ARM Thumb Interworking, branch instructions, Data processing, single register load-store, multiple register load-stores, stack instructions, software interrupt instruction.	07
4	**INTERRUPTS , MEMORY MANAGEMENT UNIT** Interrupts and exception-handling schemes; Memory architecture, Memory access sequence, translation process, access permissions, domains, Aborts.	07
5	**ARM APPLICATIONS AND PLATFORMS** ARM applications – IoT, Machine Learning, Automotive, mobile , graphics, embedded systems applications; ARM development platforms	06
6	**EMBEDDED SYSTEMS** Introduction, CISC and RISC architectures, features of 16/32 bit microcontrollers, device drivers, Interrupt servicing mechanisms, programming concepts in embedded c and c++, Prototype development phases, software design and implementation, Hardware software co design, Case study: Adaptive cruise control system in car.	06

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz
5. Solve home assignments
6. Question paper will be based on all six units.

Sr. No.	Reference Books
1	ARM architecture reference manual
2	Sloss, Symes, Wright, “ARM system developers guide” Morgan Kaufman, Elsevier, publication

3	Raj Kamal, "Embedded Systems: Architecture, Programming and Design", TMH, 2003.
4	Wolf, Wayne, "Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001
5	Vahid, Frank and Givargi, Tony, "Embedded System Design: A Unified Hardware/Software Introduction", John Wiley & Sons, New York, 2000.
6	Deshmukh, Ajay V., "Microcontroller Theory and Applications", Tata McGraw-Hill.
7	ARM7TDMI manual
8	Philips LPC 2148 manual
Sr. No.	**Important web references**
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2	https://nptel.ac.in/

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<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">OE 321-1P</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course (Program Elective I)</td></tr>
<tr><td>Course title</td><td colspan="5">ARM and Embedded Systems (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">EE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Digital Electronics , Programming Techniques , Microcontrollers</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with study of 32-bit ARM 7 architecture and understanding the fundamentals of Embedded systems</td></tr>
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5. To be familiar with embedded systems
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	2	2	3							2
CO 2	3	2	3	2	3							1
CO 3	3	2	3	2	3							2
CO 4	3	3	3	3	3							3
CO 5	3	3	3	3	3							3
CO 6	3		2	1	3							2

Level of Mapping as: Low 1, Moderate 2, High 3

	List of Experiments	Hours
1	Blinking LEDs interfaced with ARM microcontroller.	**2**
2	Switch interfacing and programming	**2**
3	Relay interfacing and programming	**2**
4	Seven segment interfacing and programming	**2**
5	DC motor clockwise and anticlockwise programming	**2**
6	ADC/DAC interfacing and programming	**2**
7	LCD interfacing and programming	**2**
8	Buzzer interfacing and programming	**2**
9	Stepper motor interfacing and programming	**2**
10	RTOS programming	**2**
11	ARM based simulation	**2**
12	Use and handling Integrated Development Environments for ARM controller	**2**

General Instructions:

1. Minimum 8 experiments should be carried out based on above list or syllabus.
2. Batch wise experiments are to be conducted. The number of students per batch should be as per the practical batches.

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<tr><td>Course Code</td><td colspan="5">PCC321-2</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course (Program Elective I)</td></tr>
<tr><td>Course title</td><td colspan="5">Computer Networks (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td>05</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Digital Electronics , Programming Techniques</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course covers fundamental concepts of computer networks. This course will introduce basics of networking from reference models (OSI and TCP), network categories, topologies and various transmissions medium. It includes all the protocols at data link and network layer. Introduction to IEEE standards and different connecting devices</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Introduce the student with fundamental concept of computer networking
2. Introduce network categories, topologies and various transmissions medium
3. Explain Working of Protocols at Data link layer
4. Introduce different addressing mechanism
5. Explain connecting devices respect to OSI model.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Explain and Compare OSI and TCP/IP reference models
2. Discuss different guided and unguided transmission media and switching techniques
3. Discuss error detection and correction mechanism for data link layer
4. Explain multiple access protocols and Data link control protocols
5. Illustrate IEEE standards and connecting devices
6. Explain congestion control, traffic shaping and protocols at network layer</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	3	2							1
CO 2	3	3	2	3	2							1
CO 3	3	3	2	3	2							2
CO 4	3	3	2	3	2							1
CO 5	3	3	2	3	2							1
CO 6	3	3	2	3	2							2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Introduction to Computer Networks** Introduction to Computer Networks, components, data representation, data flow: simplex, half duplex, full duplex, networks, Network topology: Mesh, Star, Bus, Ring, Network Categories: LAN, MAN, WAN, internet, Network Models: OSI model, TCP-IP protocol suite, Comparison of OSI and TCP-IP model, types of addressing.	07
2	**Physical Layer** Types of Guided transmission media, Types of Unguided transmission media, switching - circuit switched networks, datagram networks, virtual circuit networks.	06
3	**Data Link Layer** Error detection and correction: types of errors, Block coding : error detection and error correction, Linear Block Codes Hamming code, Cyclic Redundancy check ,Checksum	07
4	**Data link control and Medium Access Control Sublayer** Framing, flow control and error control DLL protocols: Noiseless channels and noisy channels, sliding window protocols HDLC point to point protocol Channel allocation, multiple access protocols: random access, controlled access, channelization	07
5	**Wired and Wireless LANS** IEEE Standards, Ethernet, wireless LAN IEEE 802.11, addressing mechanism, hidden station and exposed station problem, Bluetooth, zigbee, wifi, Wi-max, Connecting devices.	06
6	**Network Layer and Security** Network layer services, Packet switching, performance, congestion control algorithms, IPv4 address, IPv6 address, Transition from IPv4 to IPv6, Routing Protocols (RIP, OSPF, BGP), QoS. **Network Security:** Authentication, Authorization accounting (AAA), Multifactor authentication Virtual private Network(VPN) Remote VPN, IPSEC VPN/ Tunnel, Remote browser VPN	06

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

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2. Case study work
3. Site visit
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5. Solve home assignments
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2	Andrew S. Tanenbaum, "Computer Networks",Fourth Edition, PHI Publications
3	W. Stallings, "Data and Computer Communications", Sixth Edition, PHI Publications
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<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC321-2</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course (Program Elective I)</td></tr>
<tr><td>Course title</td><td colspan="5">Computer Networks (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">EE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">The course covers fundamental concepts of computer networks. This course will introduce basics of networking from reference models (OSI and TCP), network categories, topologies and various transmissions medium. It includes all the protocols at data link and network layer. Introduction to IEEE standards and different connecting devices</td></tr>
<tr><td>Course Rationale</td><td colspan="5">1. Introduce the student with fundamental concept of computer networking
2. Introduce network categories, topologies and various transmissions medium
3. Explain Working of Protocols at Data link layer
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<tr><td>Course Objectives</td><td colspan="5">1. Explain and Compare OSI and TCP/IP reference models
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Course Outcome and Program Outcome Mapping

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CO 1	3	3	2	3	2							1
CO 2	3	3	2	3	2							1
CO 3	3	3	2	3	2							2
CO 4	3	3	2	3	2							1
CO 5	3	3	2	3	2							1
CO 6	3	3	2	3	2							2

Level of Mapping as: Low 1, Moderate 2, High 3

	Course Content	Hours
1	Study of Half duplex and full duplex communication by using coaxial and twisted pair cable.	**2**
2	Study of Half duplex, Full duplex file transfer between two PC by using RS – 232.	**2**
3	Implementation of Local area network in packet tracer(simulation)	**2**
4	Implementation of Mesh, Bus, Star, Ring topology in packet tracer (Simulation)	**2**
5	Demonstration of bit stuffing.	**2**
6	Demonstration of Stop and wait protocol.	**2**
7	Demonstration of Go Back N protocol.	**2**
8	Demonstration of Selective repeat protocol.	**2**
9	Demonstration of error detection method using Hamming code method	**2**
10	Demonstration of error detection method using CRC method	**2**
11	Shortest path routing algorithm (By simulation)	**2**
12	Study of QOS by using NETFLOW and Live action Softwares.	**2**

General Instructions:

1. Minimum 8 experiments should be carried out based on above list or syllabus.
2. Batch wise experiments are to be conducted. The number of students per batch should be as per the practical batches.

Sr. No.	Reference Books
1	Behrouz Forouzan, “Data Communications and Networking”, Fourth Edition, TMH

2	Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, PHI Publications
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<tr><td>Course Code</td><td colspan="5">PCC321-3</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course (Program Elective I)</td></tr>
<tr><td>Course title</td><td colspan="5">Optical Fiber Communication (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td>05</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE: 30</td><td colspan="2">ESE:70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Engineering physics</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course introduces fundamentals of optical communication system. The course covers Optical fiber material properties and fabrication methods and signal distortion and degradation in optical fiber. The working principles of optical sources and detectors</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Explain fundamental concept of Optical communication system

2. Explain basic elements of optical fiber transmission link, fiber modes configurations and structures

3. Calculate different types of loss

4. Explain optical sources, materials and fiber splicing

5. Explain working of optical receivers and noise performance in photo detector

6. Explain WDM, solitons and SONET/SDH network</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Interpret functions of different blocks of optical communication

2. Understand the properties of optical fiber that affect the performance of a communication link

3. Explain types of dispersion and able to measure attenuation and scattering losses of optical fiber

4. Discuss fiber splicing, connectors and calculate intrinsic and extrinsic losses in fiber

5. Explain working principles of optical sources and detectors

6. Understand working of different optical networks and operational principles of WDM</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	3	2							1
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CO 4	3	3	2	3	2							1
CO 5	3	3	2	3	2							1
CO 6	3	3	2	3	2							2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Introduction to Optical Fiber communications** Overview of optical fiber communication system, advantages of optical fiber communications, ray theory transmission, total internal reflection, acceptance angle, numerical aperture, skew rays. V number, Single mode fibers, step index fibers, graded index fibers.	07
2	**Optical fiber material and fabrication methods** Single mode fibers,cut off wavelength, mode field diameter, effective refractive index. Fiber materials:Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers, Fiber fabrication methods: Outside vapor phase oxidation, Vapour axial deposition, Chemical vapour deposition and Plasma activated vapour deposition method.	06
3	**Signal Degradation, distortion and Fiber splicing** Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity determination, group delay, types of dispersion, material dispersion, wave guide dispersion, polarization mode dispersion, intermodal dispersion. pulse broadening.Fiber Splicing- Splicing techniques, Splicing single mode fibers. Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints,. optical fiber connectors connector types.	07
4	**Optical Sources** Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies. Reliability of LED&ILD. light emitting diodes (LEDs), laser diodes, light source linearity, modal, partition and Reflection Noise, source to fiber power launching , output patterns, power coupling, power launching, equilibrium numerical aperture, laser diode to fiber coupling.	07
5	**Optical Detectors and Receivers** physical principles of PIN and APD, detector response time, temperature effect on avalanche gain, comparison of photo detectors, optical receiver operation, fundamental	06

	receiver operation, digital signal transmission, error sources, receiver configuration, digital receiver performance, probability of error, quantum limit, analog receivers.	
6	**Optical Networks** Basic Networks, SONET/SDH, Broadcast-and –Select WDM Networks, Wavelength Routed Networks, Nonlinear Effects on Network Performance, Performance of WDM + EDFA Systems, Solitons, optical CDMA.	**06**

General Instructions:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz
5. Solve home assignments
6. Question paper will be based on all six units.

Sr. No.	**Reference Books**
1	Gerd Keiser ,"Optical Fiber Communications", 5th Edition Mc Graw-Hill International edition, 2000.
2	John M. Senior, "Optical Fiber Communications", PHI, 3rd Edition, 2020
3	D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, "Fiber Optic Communications" Pearson Education, 2005.
4	S.C .Gupta, Text Book on Optical Fibre Communication and its Applications", PHI
5	Govind P. Agarwal, John Wiley, " Fiber Optic Communication Systems",3rd Edition
6	Joseph C. Palais , "Fiber Optic Communications", 4th Edition, Pearson Education
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PCCC 321-3P</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course (Program Elective I)</td></tr>
<tr><td>Course title</td><td colspan="5">Optical Fiber Communication (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">-</td><td colspan="2">EE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Engineering physics</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course introduces fundamentals of optical communication system. The course covers Optical fiber material properties and fabrication methods and signal distortion and degradation in optical fiber. The working principles of optical sources and detectors</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Explain fundamental concept of Optical communication system
2. Explain basic elements of optical fiber transmission link, fiber modes configurations and structures
3. Calculate different types of loss
4. Explain optical sources, materials and fiber splicing
5. Explain working of optical receivers and noise performance in photo detector
6. Explain WDM, solitons and SONET/SDH network</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Interpret functions of different blocks of optical communication
2. Understand the properties of optical fiber that affect the performance of a communication link
3. Explain types of dispersion and able to measure attenuation and scattering losses of optical fiber
4. Discuss fiber splicing, connectors and calculate intrinsic and extrinsic losses in fiber
5. Explain working principles of optical sources and detectors
6. Understand working of different optical networks and operational principles of WDM</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	3	2							1
CO 2	3	3	2	3	2							1
CO 3	3	3	2	3	2							2
CO 4	3	3	2	3	2							1
CO 5	3	3	2	3	2							1
CO 6	3	3	2	3	2							2

Level of Mapping as: Low 1, Moderate 2, High 3

	List of Experiments	**Hours**
1	Setting up Fiber optic analog link	**2**
2	Setting up Fiber optic digital link	**2**
3	Intensity Modulation system using analog input signal	**2**
4	Intensity Modulation system using digital input signal	**2**
5	Frequency modulation system	**2**
6	Pulse width modulation system	**2**
7	Study of propagation loss in optical fiber	**2**
8	Measurement of Bending loss in optical fiber	**2**
9	Measurement of Numerical Aperture	**2**
10	Setting up Fiber optic voice link using Frequency modulation	**2**
11	Setting up Fiber optic voice link using PWM	**2**

General Instructions:

1. Minimum 8 experiments should be carried out based on above list or syllabus.
2. Batch wise experiments are to be conducted. The number of students per batch should be as per the practical batches.

Sr. No.	**Reference Books**
1	Gerd Keiser ,"Optical Fiber Communications", 5th Edition Mc Graw-Hill International edition, 2000.
2	John M. Senior, "Optical Fiber Communications", PHI, 3rd Edition, 2020
3	D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, "Fiber Optic Communications" Pearson Education, 2005.
4	S.C .Gupta, Text Book on Optical Fibre Communication and its Applications", PHI

5	Govind P. Agarwal, John Wiley, " Fiber Optic Communication Systems",3rd Edition
6	Joseph C. Palais , "Fiber Optic Communications", 4th Edition, Pearson Education
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<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">OE 321-1</td></tr>
<tr><td>Course Category</td><td colspan="5">Program Elective Course (Open Elective I)</td></tr>
<tr><td>Course title</td><td colspan="5">Industrial Organization and Management (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE: 30</td><td colspan="2">ESE:70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course is emphasis on the industry / organization aspects such as Management, Administration, Ethical Practices required in industry and leadership qualities. Industry drives by people working in organization. Good engineer should have knowledge of industrial environment, how organization works, and importance of team work. This course gives you introductory information about all above issue which will help you in comfortable working at industry</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Introduces the basic concepts of management and organization structure of an industry
2. Explore concept of Entrepreneurship
3. Discuss Material management and cost analysis
4. Introduce engineering economics and encourage for doing project management
5. Introduce ethical values
6. Introduce leadership qualities</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Explain the concepts of Management and organizational structure
2. Discuss the values of human and industrial relation
3. Explain industrial environment
4. Apply the project management tools effectively
5. Use ethical and professional practices
6. Demonstrate leadership quality</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1									2	1	2	3
CO 2						2		2				
CO 3									3			
CO 4					1		2		2		2	1
CO 5								3				
CO 6									2			3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Organization and Management** Organization: Concept, Important, Characteristics, Elements, Structure and process of an industrial organization, Types of Organization, Functions of different departments. Relationship between individual departments. Management, Administration, Principals, process, functions and Characteristics of management, Objectives of management	07
2	**Human and Industrial Relations** Human relations and performance in organization, Understand self and others for effective behavior, Behaviour modification techniques, Industrial relations and disputes, Relations with subordinates, peers and superiors, Characteristics of group behaviour and trade unionism, Mob psycholog, Grievance, handling of grievances, Agitations, strikes, lockouts, picketting and gherao, Labour welfare, Workers' participation in management. Functions of HRD manager: Introduction, Staff development and career development, Training strategies and methods	06
3	**Industrial Psychology and Leadership** Industrial Psychology and personal management, aim, objective and scope. Individual and group, difference in behavior, moral, Motivation: Factors determining motivation, Characteristics of motivation, Methods for improving motivation, Incentives, pay, promotion, rewards, Job satisfaction and job enrichment. Leadership: Need for leadership, Functions of a leader, Factors for accomplishing effective, leadership, Manager as a leader	07
4	**Materials and Financial Management** Material management, procurement, buying techniques, purchase procedure, accounting, physical verification. Financial Management: Types of capital, sources of capital, book keeping, assets, capital gearing, return of investment.	07
5	**Professional ethics and environmental pollution** Concept, ethics and moral, business and professional ethics, importance and need of ethics , ethical dilemmas, ethical problem in business. *Pollution:* ecology, factors causing pollutions, effect of pollution on wealth, air and water pollution and control, solid waste management, noise and control.	06
6	**Cost accounting and control**	06

	Elements of cost, prime cost, overheads, factory and total cost. Selling price, nature and type of cost, process and production cost. Depreciation, breakeven analysis and chart	

Assignments: Based on the following activity

- The Assignment work includes six assignments based on theory curriculum
  and
- The tutorial work is also consisting of the industrial survey and report writing. Students have to follow the guidelines given below. Evaluation of the students will be done on completion of the report and presentation.
  1. Form the group of students not exceeds than five.
  2. Select the appropriate product or service based industry in the nearby region.
  3. Take permission of industry for the visit.
  4. Visit the industry and make the survey with respect to organization structure, various departments and their functions, processing of raw material to form final product, administration, vision, mission, goals, growth etc.
  5. Go for multiple visits if required.
  6. Prepare the Industrial Survey report in detail and submit at the end of semester.

Prepare and make presentation on the industrial survey.

Sr. No.	Reference Books
1	OP Khanna, 'Industrial Engineering and Management', Dhanpat Rai Publications, Delhi.
2	T R Banga, 'Industrial Engineering and Management', TMH Publications
3	J. Michael. Jacob —Application & Design with Analog Integrated Circuits, PHI.
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">OE 321-2</td></tr>
<tr><td>Course Category</td><td colspan="5">Program Elective Course (Open Elective I)</td></tr>
<tr><td>Course title</td><td colspan="5">Professional Communication (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE: 30</td><td colspan="2">ESE:70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Professional Communication course is designed to equip students with essential communication skills required for success in academic, professional, and business environments. Effective communication is a crucial competency in today’s globalized world, where professionals must convey their ideas clearly, persuasively, and professionally in various settings</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1.Enhance Verbal and Non-Verbal Communication Skills
2.Improve Business and Technical Writing
3.Develop Public Speaking and Presentation Skills
4.Strengthen Interpersonal and Team Communication
5.Adapt to Digital and Cross-Cultural Communication
6.Prepare for Career Success</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1.Communicate Effectively in Professional Settings
2.Write Clear and Professional Documents
3.Deliver Engaging and Persuasive Presentations
4.Demonstrate Strong Interpersonal and Teamwork Skills
5.Adapt to Digital and Cross-Cultural Communication
6.Enhance Employability and Professional Growth</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1										3	2	2
CO 2								2				2
CO 3										3	2	1
CO 4										3		2
CO 5										2		1
CO 6								1	2	2	2	1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	Communication principles: Business and professional excellence in the workplace, Verbal and non-verbal communication, Listening	**07**
2	Entering the workplace: Resumes, interviews and negotiations; Diverse workplace,	**06**
3	Developing in the workplace: Interpersonal communication, Strengthening terms and conducting meetings,	**07**
4	Excellence in the workplace: Technology in the workplace, Business and professional writings, Leadership and conflict management,	**07**
5	Presenting in the workplace: Informing and persuading, Speech design, speech delivering	**06**
6	Surviving in the workplace: Work life balance	**06**

Assignments: Based on the following activity

- The Assignment work includes six assignments based on theory curriculum
  and
- The tutorial work is also consisting of the industrial survey and report writing. Students have to follow the guidelines given below. Evaluation of the students will be done on completion of the report and presentation.
  1.Form the group of students not exceeds than five.
  2.Select the appropriate product or service based industry in the nearby region.
  3.Take permission of industry for the visit.
  4.Visit the industry and make the survey with respect to organization structure, various departments and their functions, processing of raw material to form final product, administration, vision, mission, goals, growth etc.

5.Go for multiple visits if required. 6.Prepare the Industrial Survey report in detail and submit at the end of semester. 7.Prepare and make presentation on the industrial survey.	
Sr. No.	**Reference Books**
1	Kelly M.Quintanilla, Shawn T. Wahl,"Business and progessional Communication-Keys for workplace excellence", 4th Edition, Sage publications
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">AEC321</td></tr>
<tr><td>Course Category</td><td colspan="5">Ability Enhancement Course</td></tr>
<tr><td>Course title</td><td colspan="5">Mini project and industrial visit</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">IE:50</td><td colspan="2">EE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Electronic circuit design, Analog Electronics, Digital Electronics, Microcontrollers,</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with inculcating students skills for design, development, simulation, programming of electronics / software based systems to solve societal/ industrial problems.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Illustrate basic steps in electronic system design
2. Survey the problem and find technological solution
3. Design small scale electronics systems to accomplish task
4. Construct circuit models and simulate
5. Work in team to complete the task
6. Manage project in given time</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Illustrate fundamental stages in development of electronics engineering projects
2. Apply engineering knowledge for providing technological solutions
3. Simulate and design the circuits
4. Work in team environment
5. Write report , consider ethical issues in report writing / project management and express technical details
6. Consider social, environmental, industrial issues</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	2	3					1	2	2
CO 2	3	3	3	2	3					1	2	2
CO 3	3	3	3	2	3					1	2	2
CO 4	3	3	3	2	3					1	2	2
CO 5	3	3	3	2	3	2		3		2	2	2
CO 6	2	2	1	2	2	2	1	1	3	1	2	2

Level of Mapping as: Low 1, Moderate 2, High 3

	Curriculum Content	**Hours**
1	**Curriculum Content** Group size and activities: 1) Mini project group size should not exceed three students per every group. 2) Project idea should be proposed and finalized in consultation with guide. 3) Proposed weekly plan of the project should be finalized with guide. 4) Project work should be carried out in following steps a) Selection of project & problem definition. b) Paper design (Circuit design and flow chart of software) c) Simulation if required. d) Hardware implementation e) Software implementation (if required) f) Testing and calibration g) Report writing 5) Compulsory submission of mini project report by each group is a must. 6) Projects of two or more groups should not be same. 7) Seminar must be delivered after completion of project by each group preferably by using power point presentation. 8) Mini-project report must be submitted before/at the time of viva-voce . Project Contents: 1) It should consists of hardware part and software part is optional. 2) Design of PCB by using suitable CAD tool, simulation if necessary, component mounting, soldering, testing , result analysis should be done by group. 3) Design and development of cabinet should be done for the project. **Guidelines for mini-project selection** Parameter monitoring, parameter / system controlling applications, data acquisition systems, microcontroller based systems, digital design, communication projects, VLSI based project, power supply and batteries **Guidelines for industrial visit** A visit should be arranged to suitable industry. Students have to submit the report of the industrial visit to department.	

General Instructions:

1. A mini project report should be submitted by students to department in the given format.
2. Industrial visit report should be submitted to department in given format.

Sr. No.	**Reference Books**
1	Articles from reputed journals, magazines, websites, real world problems, case studies
Sr. No.	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">VSEC321</td></tr>
<tr><td>Course Category</td><td colspan="5">Vocational and skill enhancement course</td></tr>
<tr><td>Course title</td><td colspan="5">Design Thinking and Innovation- III</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>01</td><td>-</td><td>-</td><td>01</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE: NIL</td><td colspan="2">ESE:NIL</td><td>IE should be conducted at course in-charge end</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">--</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Design Thinking & Innovation III course aims to bridge the gap between conceptual design and real-world application. By integrating advanced design thinking methodologies with industry-relevant challenges, the course prepares students to develop, validate, and execute innovative solutions. This progression ensures that students transition from ideation to actionable strategies that are market-ready and impactful</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1.To advance students' capabilities in synthesizing complex design challenges into feasible solutions.

2.To refine iterative problem-solving skills through industry-focused projects and case studies.

3.To cultivate a proactive, entrepreneurial mindset that addresses sustainability and societal needs.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Analyze complex problems to develop innovative, user-centric design solutions

2. Apply advanced prototyping techniques to validate and optimize product concepts

3. Collaborate effectively across disciplines to deliver actionable and sustainable innovations

4. Evaluate and align solutions with market trends, user feedback, and ethical considerations</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	3			2						
CO 2	2		2	2	3							
CO 3									3	3		
CO 4												
CO 5												
CO 6	2						3					2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Design Thinking Framework Revisited** Advanced principles of empathy, ideation, and prototyping. Reflection on learning from Design Thinking & Innovation I and II. Introduction to systems thinking in the design context	2
2	**Problem Scoping and Opportunity Identification** Techniques for problem discovery and framing. Identifying gaps and opportunities in existing systems. Leveraging tools like Journey Mapping and SWOT Analysis	2
3	**Ideation Techniques and Advanced Prototyping** Brainstorming 2.0: Mind Mapping and SCAMPER techniques. Prototyping with a focus on technology integration. Real-world prototyping examples from diverse industries	2
4	**Validation and Iterative Development** Usability testing methods and feedback incorporation. Iterative design models: Agile and Lean principles. Creating Minimum Viable Products (MVPs).	2
5	**Innovation Strategy and Entrepreneurship** Bridging design with business models (Canvas Model). Strategies for market positioning and scaling innovations. Ethical considerations and sustainable innovation practices	2
6	**Case Studies and Capstone Projects** Real-world applications of design thinking in Electronics & Telecommunication Engineering. Group projects focusing on an innovative solution for an industry-related problem. Presentation and feedback	2
Pedagogical Strategies		

- **Interactive Sessions:** Facilitators to encourage collaborative discussions and problem-solving activities.
- **Hands-On Assignments:** Individual and group-based projects for practical application.
- **Case Studies:** Industry-specific scenarios for analysis and solution generation.
- **Technology Integration:** Use of tools like Miro, Figma, or Scilab for design processes.

Assessment Methods

- **Formative Assessments:**

  Assignments: Application of unit-specific tools (20%).

  Group Activities: Problem framing and solution ideation tasks (30%).

- **Summative Assessments:**

  Final Presentation of Capstone Project (50%).

Sr. No.	Reference Books
1	Brown, T. (2009). *Change by Design*. HarperBusiness.
2	Lewrick, M., Link, P., & Leifer, L. (2018). *The Design Thinking Playbook*. Wiley.
3	Plattner, H., Meinel, C., & Leifer, L. (2020). *Design Thinking Research*. Springer.
4	Christensen, C. M. (2013). *The Innovator's Dilemma*. Harvard Business Review Press.
Sr. No.	**Important web references**
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<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Electronics & Telecommunication Engineering), Part 3, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">MAC321</td></tr>
<tr><td>Course Category</td><td colspan="5">Mandatory Audit Course</td></tr>
<tr><td>Course title</td><td colspan="5">Aptitude Enhancement Course III</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td>02</td><td>02</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:NIL</td><td colspan="2">ESE: NIL</td><td>IE should be conducted at course in-charge end</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Aptitude Enhancement Course 1, 2</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course sharpens cognitive skills, decision-making, and industry-relevant problem-solving, preparing students for competitive exams and professional challenges.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The Course is aimed to-
1.Equip students with techniques for solving quantitative aptitude problems like interest and mixture.
2.Enhance logical reasoning abilities, including decision-making and assertion-reason analysis.
3.Develop skills to calculate and apply geometric areas, volumes, and surface areas in problem-solving.
4.Introduce fundamental concepts of probability and statistics for solving quantitative problems.
5.Strengthen abilities to solve time-based problems, improving speed and accuracy.
6.Train students to recognize and solve logical sequences and patterns in reasoning and mathematics.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to –
1.Solve quantitative aptitude problems related to Boats and Streams, Trains, Mixtures, and Interest calculations effectively.
2.Develop logical reasoning skills for problems like decision-making, number ranking, and time sequence tests.
3.Calculate areas, volumes, and surface areas of geometric shapes and apply them to practical problems.
4.Apply probability and statistical analysis in solving real-world problems like stocks, shares, and series.
5.Solve time-based problems involving calendars, clocks, and distances, enhancing time management skills.
6.Master advanced techniques in Permutations, Combinations, and other mathematical concepts for higher-level exams.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	2									1
CO 2	3	1	2									1
CO 3	3	1	2									1
CO 4	3	1	2									1
CO 5	1		1									1
CO 6	1		1									1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Quantitative Aptitude 1** Boats and Streams, Problems on Trains, Allegation or Mixture, Simple Interest.	2
2	**Quantitative Aptitude 2** Compound Interest, Area, Volume and Surface Area, Races and Games of Skill.	2
3	**Quantitative Aptitude 3** Calendar, Clocks, Stocks and Shares, Permutations and Combinations.	2
4	**Quantitative Aptitude 4** Probability, True Discount, Banker's Discount, Heights and Distances, Odd Man Out and Series.	2
5	**Logical Reasoning 1** Number ranking and time sequence test, Decision making, Assertion and reason, Situation reaction Test.	2
6	**Logical Reasoning 2** Mathematical Operations, Inserting the missing one, logical sequence of words.	2
General Instructions: Each Student has to write at least 6 assignments on entire syllabus.		
Sr. No.	**Reference Books**	
1	Dr. R S Aggarwal — Quantitative aptitude, S. Chand Publication.	
2	R V Praveen — Quantitative aptitude and logical reasoning, 2nd Edition, PHI Publication.	
	Assessment	
	Assessment will be done by Course Teacher. MCQ Test can be conducted based on the syllabus.	
Sr. No.	**Important web references**	
1	https://swayam.gov.in/	
2	https://nptel.ac.in/	

SEM – V

Sr. No.	Third Year B. Tech Semester V Pre-revised syllabus	Third Year B. Tech Semester V Revised syllabus (NEP -2020)	Remark
1	Power Electronics	Power Electronics	Minor changes are done
2	Electromagnetic Fields	Electromagnetic Fields	Minor changes are done
3	Microcontrollers	Microcontrollers	Minor changes are done
4	Signals & Systems		Minor changes are done
5	Computer Networks	Shifted to 6th Semester as program elective	
6		Digital Signal Processing	Shifted from 6th Semester to 5th Semester
7		Multi Disciplinary Minor Course II	Newly added
8	Advanced programming Techniques	Advanced programming Techniques	
9	Power Electronics Laboratory	Power Electronics Laboratory	
10	Electromagnetic Fields Tutorial	Electromagnetic Fields Tutorial	
11	Microcontrollers Laboratory	Microcontrollers Laboratory	
12	Computer Networks Laboratory	Shifted to 6th Semester as program elective	
13	Advanced programming techniques	Advanced programming techniques	
14	Internship-I	Replaced with Mini Project 1	
15	Research Methodology (Audit Course)		
16		Introduction to foreign language	Shifted from 6th Semester to 5th Semester
17		Aptitude Enhancement Course 2	Newly added

SEM – VI

Sr. No.	Third Year B. Tech Semester VI Pre-revised syllabus	Third Year B. Tech Semester VI Revised syllabus (NEP-2020)	Remark
1	Digital Signal Processing		Shifted to 5th Semester , Minor changes are done
2	Digital Communication		Removed from TY curriculum , Minor changes are done
3	Antenna & Wave Propagation	Antenna & Wave Propagation	Minor changes are done
4	VLSI Design	VLSI Design	Minor changes are done
5	Control Systems	Control Systems	Minor changes are done
6		Multidisciplinary Minor Course 3	Newly added
7		**Program Elective 1** 1. ARM & Embedded systems 2. Computer Networks 3. Optical Fiber Communication	Newly Added
8		**Open Elective 1** 1.Industrial Organization and Management 2. Professional Communication	Newly added
9	Digital Signal Processing Laboratory		Removed
10	Digital Communication Laboratory		Minor changes are done
11	Antenna & Wave Propagation Laboratory		Minor changes are done
12	VLSI Design Laboratory		Minor changes are done
13	Seminar		Removed
14	Mini Project and Seminar Laboratory	Mini Project and Industrial Visit	Minor changes are done
15	Introduction to foreign language		Minor changes are done
16		Design Thinking & innovation 3	Newly added
17		Aptitude Enhancement Course 3	Newly added

Shivaji University Vidyanagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Pool of Multidisciplinary Minors for MDM Featured B. Tech (Electronics & Telecommunication Engineering), Detailed Curriculum

Multidisciplinary Minor
In
Artificial Intelligence and Machine Learning

For
B.Tech (Electronics & Telecommunication Engineering)

Shivaji University, Kolhapur
Department of Technology

Multidisciplinary Minor in Artificial Intelligence and Machine Learning

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	MDM 1.1	Introduction to AI & Machine Learning	03	-	-	03	03	30:70	00:00
2.		MDM 1.2	Introduction to Data Analytics	03	-	-	03	03	30:70	00:00
3.		MDM 1.3	Deep Learning and Neural Network	03	-	-	03	03	30:70	00:00
4.	Program Based Internship	MDM 1.4	AI ML Related Internship	One Month			-	03	-	50:50
5.	Project Based Learning	MDM 1.5	Mini Project	-	-	-	-	02	-	50:50
				-	**-**	**-**	**-**	**14**	**300**	**200**
			Total Hours	**09**	**00**	**00**	**09**	**-**	**-**	**-**

Note: MDM Program's Internship and Mini Project need to be planned during winter or summer vacation days after 4th semester while respective evaluations will be the part of 7th and 8th Semesters of the B.Tech Major structure.

Multidisciplinary Minor II: Artificial Intelligence and Machine Learning

Year, Program, Semester	Multidisciplinary Minor I , 4th Semester Onwards							
Course Code	MDM-1.1							
Course Category	Minor Program Core							
Course title	**Introduction to AI & Machine Learning**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**			**Total Credits**	
	03	-	-	03			03	
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total	
	30	70	-	-	-	-	100	
Pre-requisites(if any)	Mathematical concepts such as statistics, calculus, probability, and linear algebra.							
Course Objectives	The Course is aimed to 1. To review and strengthen important mathematical concepts required for AI &ML. 2. Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.							
Course Outcomes	Upon completion of this course, student should be able to 1. Design and implement machine learning solutions to classification, regression and clustering problems. 2. Evaluate and interpret the results of the different ML techniques. 3. Design and implement various machine learning algorithms in a range of Real-world applications.							

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	3	-	-	-	-	-	-	-
CO 2	2	-	2	-	3	-	-	-	-	-	-	-
CO 3	-	-	2	-	2	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.	9
II	Idea of Machines learning from data, Classification of problem –Regression and Classification, Supervised and Unsupervised learning.	8

III	Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.	8
IV	Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.	8
V	Discussion on clustering algorithms and use-cases cantered around clustering and classification.	6

Text / Reference Books

1.	Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011
2.	Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.
3.	Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.
4.	Tom Mitchell, Machine Learning, McGraw Hill, 2017.
5.	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
6.	T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

Note: Though it's a theory course, there will be classes on computers for hands on practice. The activity content for the same is as follows.

- Implementation of logical rules in Python
- Using any data apply the concept of: Liner regression, Gradient decent, Logistic regression
- To add the missing value in any data set.
- Perform and plot under fitting and overfitting in a data set.
- Implementation of clustering and classification algorithms.

Year, Program, Semester	Multidisciplinary Minor I , 4th Semester Onwards						
Course Code	MDM-1.2						
Course Category	Minor Program Core						
Course title	**Introduction to Data Analytics**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	03	-	-	03		03	
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total
	30	70	-	-	-	-	100
Pre-requisites(if any)	Solid foundation in basic mathematics, including algebra, calculus, and probability.						
Course Objectives	The Course is aimed to 1. Provide the knowledge and expertise to become a proficient data scientist 2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science 3. Produce Python code to statistically analyses a dataset 4. Critically evaluate data visualizations based on their design and use for communicating stories from data.						
Course Outcomes	Upon completion of this course, student should be able to 1. Explain how data is collected, managed and stored for data science. 2. Understand the key concepts in data science, including their real- world applications and the toolkit used by data scientists. 3. Implement data collection and management scripts using MongoDB.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	3	-	-	-	-	-	-	-	-
CO 2	-	-	-	-	3	-	-	-	-	-	-	-
CO 3	-	-	2	2	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.	7
II	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions.	7
III	Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, role of domain expertise, and place for imagination)- Feature Selection algorithms.	9
IV	Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex	9

	dataset.	
V	Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy,security, ethics- A look back at Data Science- Next-generation data scientists.	7
Text / Reference Books		
1.	Joel Grus, Data Science from Scratch, Shroff Publisher Publisher /O'Reilly PublisherMedia	
2.	Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher	
3.	Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher Media.	
4.	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.	
5.	Jake VanderPlas, Python Data Science Handbook, Shroff Publisher Publisher 'Reilly Publisher Media	
6.	Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher /O'Reilly Publisher Media.	
Note: Though it's a theory course, there will be classes on computers for hands on practice. The activity content for the same is as follows.		
• Python Environment setup and Essentials. • Mathematical computing with Python (NumPy). • Scientific Computing with Python (SciPy). • Data Manipulation with Pandas. • Prediction using Scikit-Learn • Data Visualization in python using matplotlib		

Year, Program, Semester	Multidisciplinary Minor I , 4th Semester Onwards						
Course Code	MDM-1.3						
Course Category	Minor Program Core						
Course title	**Deep Learning and Neural Network**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**			**Total Credits**
	03	-	-	03			03
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total
	30	70	-	-	-	-	100
Pre-requisites(if any)	Basic Mathematics, matrix arithmetic, probability.						
Course Objectives	The Course is aimed to 1. Strengthen important Mathematical concepts required for Deep learning and neural network. 2. Get a detailed insight of advanced algorithms of neural networks. 3. Introduce different deep learning network.						
Course Outcomes	Upon completion of this course, student should be able to 1. Design and implement Artificial Neural networks. 2. Decide when to use which type of NN. 3. Implement and analyze various deep learning architectures						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	2	-	2	-	-	-	-	-	-	-
CO 2	-	2	-	-	2	-	-	-	-	-	-	-
CO3	-	2	3	-	3	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Information flow in a neural network, understanding basic structure and ANN	8
II	Training a Neural network, how to determine hidden layers, recurrent neural network	8
III	Convolutional neural networks, image classification and CNN.	8
IV	RNN and LSTMs. Applications of RNN in real world.	8
V	Creating and deploying networks using tensor flow and keras	7
Text / Reference Books		
1.	John Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons.	
2.	Adam Gibson, Josh Patterson, Deep Learning, A Practitioner's Approach, Shroff Publisher /O'Reilly Publisher Media.	
3.	Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford.	

4.	Russell Reed, Robert J MarksII, Neural Smithing: Supervised Learning inFeedforward Artificial Neural Networks, Bradford Book Publishers

Note: Though it's a theory course, there will be classes on computers for hands on practice. The activity content for the same is as follows.

- Introduction to Kaggle and how it can be used to enhance visibility.
- Build general features to build a model for text analytics.
- Build and deploy your own deep neural network on a website using tensor flow.

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">Multidisciplinary Minor I, 4th Semester onwards</td></tr>
<tr><td>Course Code</td><td colspan="7">MDM 1.4</td></tr>
<tr><td>Course Category</td><td colspan="7">Program Based Internship</td></tr>
<tr><td>Course Title</td><td colspan="7">AI ML Related Internship</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td colspan="5">One Month</td><td colspan="2">03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td colspan="2">ESE</td><td>IOE</td><td>IPE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">00</td><td colspan="2">00</td><td>--</td><td>-</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Basics of unit processes and unit operations.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The course caters specifically to B.Tech Electronics & Telecommunication Engineering students as the part of multidisciplinary Minor with respect to AI & ML applications. This course offers practical exposure to industry settings aligned with their chosen discipline, aiming to bridge the gap between theoretical knowledge and practical application. By engaging in a one-month internship, students gain firsthand experience, essential skills, and insights crucial for their future careers in additional sector of industry.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course teacher will
1. Help expose students to the 'real' working environment;
2. Promote hands-on experience to the students’ in their related field;
3. Develop synergetic collaboration between industry and the university in promoting a knowledgeable society;
4. Assist in providing the opportunity for students to test their interest in a particular career before permanent commitments are made.
5. Elaborate the dynamic and challenging nature of industrial environments.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to
1. Understand industrial processes and operations related to their minor sub-specializations.
2. Apply theoretical concepts to solve practical problems in the industry.
3. Communicate effectively with industry professionals, colleagues, and supervisors.
4. Collaborate efficiently in team environments to complete tasks and projects.
5. Adapt to the dynamic and challenging nature of industrial environments.
6. Reflect on internship experiences for personal and professional growth.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	-	-	-	-	-	-	-	-	3	-	-	-
CO 5	-	-	-	-	-	2	-	-	-	-	-	3
CO 6	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	**Hours**
The course consists of a one-month internship with respect to applications of AI & ML. Students will be placed in companies or organizations that align with the particular requirement. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2. Assisting with ongoing projects or research initiatives within the organization. 3. Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4. Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5. Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6. Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

Course Evaluation Method

This particular evaluation will be the part of the structure of 7th Semester.

The evaluation for the Industrial Internship course will be conducted as follows:

- **Internal Evaluation (50 marks):**
    - Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks.
    - Evaluation by industrial supervisors on students' professional conduct, technical skills,

problem-solving abilities, and overall performance in the workplace.

- **External Evaluation (50 marks):**
    - Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period.
    - The external examiner will review the quality of students' reflections on their internship experience, their ability to apply theoretical knowledge to practical situations, and the depth of their understanding of industry practices and challenges.

The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.

Year, Program, Semester	Multidisciplinary Minor I, 4th Semester onwards						
Course Code	MDM 1.5						
Course Category	Project Based Learning						
Course Title	**Mini Project**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	-	-	-		02	
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**IE**	**EE**	**Total**
	00	00		-	-	50	50	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this field project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena for AI ML applications.						
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.						
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets with respect to application of AI & ML.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process
This particular evaluation will be the part of 8th Semester of the major structure. The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work. The teachers will follow the instructions as below: Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including: • Rubric-based assessment for the project work and its report. • Peer evaluation for project. • Instructor-led discussions or presentations to evaluate communication skills and critical thinking. • Overall course grading based on a weighted average of individual assessments and participation. The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Multidisciplinary Minor
In
Cyber Security

For
B.Tech (Electronics & Telecommunication Engineering)

Shivaji University, Kolhapur
Department of Technology

Multidisciplinary Minor in Cyber Security

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	MDM 2.1	Information Theory for Cyber Security	03	-	-	03	03	30:70	00:00
2.		MDM 2.2	Data Encryption	03	-	-	03	03	30:70	00:00
3.		MDM 2.3	Steganography and Digital Watermarking	03	-	-	03	03	30:70	00:00
4.	Program Based Internship	MDM 2.4	Cyber Security Related Internship	One Month			-	03	-	50:50
5.	Project Based Learning	MDM 2.5	Mini Project	-	-	-	-	02	-	50:50
				-	**-**	**-**	**-**	**14**	**300**	**200**
			Total Hours	**09**	**00**	**00**	**09**	**-**	**-**	**-**

Note: MDM Program's Internship and Mini Project need to be planned during winter or summer vacation days after 4th semester while respective evaluations will be the part of 7th and 8th Semesters of the B.Tech Major structure.

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards					
Course Code	MDM 2.1					
Course Category	Minor Program Core					
Course title	**Information Theory for Cyber Security**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	3	-	-	3		3
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	30		70	00	00	100
Pre-requisites(if any)	Basic Mathematics					
Course Objectives	The Course is aimed to- 1. Provide a foundation of information theory, basics of random variables, and probability distribution factors. 2. Describe details about secrecy, authentication and block codes 3. Theoretic of security and cryptographic techniques 4. Provide details of secrecy metrics and secure source coding 5. Overview of digital forensics, public key cryptography					
Course Outcomes	After completion of the course, students would be able to: 1. Understand the foundation of information theory, the basics of random variables, and probability distribution factors. 2. Justify details about secrecy, authentication and block codes 3. Explain theoretic of security and cryptographic techniques 4. Analyze secrecy metrics and secure source coding 5. Overview of digital forensics, public key cryptography					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1		1											
CO 2	2	2	1	2	1								2		
CO 3	3	2	1	1	1								2		
CO 4	2	3	2	1	1								2		
CO 5	2	2	2		1								1		

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Shannon's foundation of Information theory, Random variables, Probability distribution factors, Uncertainty/entropy information measures, Leakage, Quantifying Leakage and Partitions, Lower bounds on key size: secrecy, authentication and secret sharing. Provable security, computationally secure, symmetric cipher.	8
II	Secrecy, Authentication, Secret sharing, Optimistic results on perfect secrecy, Secret key agreement, Unconditional Security, Quantum Cryptography, Randomized Ciphers, Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques.	8
III	Information-theoretic security and cryptograph, basic introduction to Diffie-Hellman, AES, and side-channel attacks.	7
IV	Secrecy metrics: strong, weak, semantic security, partial secrecy, Secure source coding: rate-distortion theory for secrecy systems, side information at receivers, Differential privacy, Distributed channel synthesis.	9
v	Digital and network forensics, Public Key Infrastructure, Light weight cryptography, Elliptic Curve Cryptography and applications.	7
Text Books		
i)	Information Theory and Coding, Muralidhar Kulkarni, K S Shivaprakasha, John Wiley and Sons.	
ii)	Communication Systems: Analog and digital, Singh and Sapre, Tata McGraw Hill.	
Reference Books		
i)	Fundamentals in information theory and coding, Monica Borda, Springer.	
ii)	Information Theory, Coding and Cryptography R Bose.	
Iii]	Multi-media System Design, Prabhat K Andleigh and Kiran Thakrar.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards					
Course Code	MDM 2.2					
Course Category	Minor Program Core					
Course title	**Data Encryption**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	3	-	-	3		3
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	30		70	00	00	100
Pre-requisites(if any)	Basic Mathematics					
Course Objectives	The Course is aimed to- 1. Provide knowledge of basics of cryptography, and some key encryption techniques. 2. Explain modern cryptosystems and public key cryptography 3. Discuss case studies and security policies such as authentication, integrity and confidentiality, Provide Knowledge of key management and key distribution 4. Introduce the concept of data compression 5. Discuss in detail the entropy encoding 6. Discuss recent trends in encryption and data compression techniques.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Describe basic terminology in cryptography, and classical cryptosystems. 2. Explain modern cryptosystems. concepts of public key cryptography 3. Discuss case studies and analyse security policies such as authentication, integrity and confidentiality and key management and key distribution 4. Understand the concept of data compression 5. Analyse the entropy encoding. 6. Explain recent trends in encryption and data compression techniques.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1	1		1								1		
CO 2	2	2	1	1	1								1		
CO 3	2	2	1	1	1								1		
CO 4	2	2		1	1										
CO 5	2	2	2	2	1										
CO6	2	2	2	2	2								1		

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Introduction to Security: Need for security, Security approaches, Principles of security, Types of attacks. Encryption Techniques: Plaintext, Cipher text, Substitution; Transposition techniques, Encryption; Decryption, Types of attacks, Key range; Size.	7
II	Symmetric ; Asymmetric Key Cryptography: Algorithm types; Modes, DES, IDEA, Differential; Linear Cryptanalysis, RSA, Symmetric; Asymmetric key together, Digital signature, Knapsack algorithm.	6
III	Case Studies of Cryptography: Denial of service attacks, IP spoofing attacks, Conventional Encryption and Message Confidentiality, Conventional Encryption Algorithms, Key Distribution. Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management, Firewall..	8
IV	Introduction: Need for data compression, Fundamental concept of data compression coding, Communication model, Compression ratio, Requirements of data compression, Classification. Methods of Data Compression: Data compression-- Loss less; Lossy.	7
v	Entropy encoding-- Repetitive character encoding, Run length encoding, Zero/Blank encoding; Statistical encoding-- Huffman, Arithmetic ; Lempel-Ziv coding; Source encoding-- Vector quantization (Simple vector quantization ; with error term).	7
vi	Recent trends in encryption and data compression techniques.	4
	Text Books	
i)	Cryptography and Network Security, Mohammad Amjad, John Wiley and Sons.	
ii)	Cryptography and Network Security by Atul Kahate, TMH.	
	Reference Books	
i)	Information Theory and Coding, Muralidhar Kulkarni, K S Shivaprakasha, John Wiley and Sons.	
ii)	Cryptography and Network Security by B. Forouzan, McGraw-Hill.	
Iii]	The Data Compression Book by Nelson, BPB.	
	Assessment	
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards					
Course Code	MDM 2.3					
Course Category	Minor Program Core					
Course title	**Steganography and Digital Watermarking**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	3	-	-	3		3
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	30		70	00	00	100
Pre-requisites(if any)	Basic Mathematics					
Course Objectives	The Course is aimed to- 1. Provide an insight into steganography techniques. 2. Details of a framework for secrete communication 3. Details of steganography techniques. 4. Overview of Detection, Distortion Techniques 5. Study of digital Watermarking techniques along with attacks on data hiding and integrity of data 6. Provide details of recent trends in digital watermarking and steganography					
Course Outcomes	Upon completion of this course, student should be able to – 1. Learn the concept of information hiding. 2. Understand details of a framework for secrete communication 3. Survey of current techniques of steganography and learn how to detect and extract hidden information. 4. Analyze detection and Distortion Techniques 5. Learn watermarking techniques and through examples understand the concept. 6. Understand recent trends in digital watermarking and steganography					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	1										
CO 2	2	2	2	1	2										
CO 3	2	2	-	-	-										
CO 4	2	2	2	2	2										
CO 5	2	2	2	2	2										
CO 6	1	2	2	2	2								1		

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.). Steganalysis: Active and Malicious Attackers, Active and passive Steganalysis.	7
II	Frameworks for secret communication (pure steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive).	6
III	Steganography techniques: Substitution systems, Spatial Domain, transform domain techniques, Spread spectrum, Statistical steganography.	8
IV	Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets.	7
v	Digital Watermarking: Introduction, Difference between Watermarking and Steganography, Classification (Characteristics and Applications), types and techniques (Spatial-domain, Frequency-domain, and Vector quantization- based watermarking), Watermark security; authentication.	7
vi	Recent trends in Steganography and digital watermarking techniques. Case study of LSB Embedding, LSB Steganalysis using primary sets.	4
Text Books		
i)	Peter Wayner, "Disappearing Cryptography – Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002..	
ii)	Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker, "Digital Watermarking and Steganography", Margan Kaufmann Publishers, NewYork, 2008.	
Reference Books		
i)	Information Hiding: Steganography and Watermarking-Attacks and Countermeasures by Neil F. Johnson, Zoran Duric, Sushil Jajodia.	
ii)	Information Hiding Techniques for Steganography and Digital Watermarking by Stefan Katzenbeisser, Fabien A. P. Petitcolas..	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards						
Course Code	MDM 2.4						
Course Category	Program Based Internship						
Course Title	**Cyber Security Related Internship**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	One Month				03		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**IE**	**EE**	**Total**
	00	00		-	-	50	50	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	The course caters specifically to B.Tech Electronics & Telecommunication Engineering students as the part of multidisciplinary Minor with respect to Cyber security applications. This course offers practical exposure to industry settings aligned with their chosen discipline, aiming to bridge the gap between theoretical knowledge and practical application. By engaging in a one-month internship, students gain firsthand experience, essential skills, and insights crucial for their future careers in additional sector of industry.						
Course Objectives	The course teacher will 1. Help expose students to the 'real' working environment; 2.Promote hands-on experience to the students' in their related field; 3.Develop synergetic collaboration between industry and the university in promoting a knowledgeable society; 4.Assist in providing the opportunity for students to test their interest in a particular career before permanent commitments are made. 5.Elaborate the dynamic and challenging nature of industrial environments.						
Course Outcomes	Upon completion of this course, student should be able to 1.Understand industrial processes and operations related to their minor sub-specializations. 2.Apply theoretical concepts to solve practical problems in the industry. 3.Communicate effectively with industry professionals, colleagues, and supervisors. 4.Collaborate efficiently in team environments to complete tasks and projects. 5.Adapt to the dynamic and challenging nature of industrial environments. 6.Reflect on internship experiences for personal and professional growth.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	-	-	-	-	-	-	-	-	3	-	-	-
CO 5	-	-	-	-	-	2	-	-	-	-	-	3
CO 6	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	**Hours**
The course consists of a one-month internship with respect to applications of AI & ML. Students will be placed in companies or organizations that align with the particular requirement. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2.Assisting with ongoing projects or research initiatives within the organization. 3.Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4.Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5.Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6.Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

Course Evaluation Method

This particular evaluation will be the part of the structure of 7th Semester.

The evaluation for the Industrial Internship course will be conducted as follows:

- **Internal Evaluation (50 marks):**
  - Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks.
  - Evaluation by industrial supervisors on students' professional conduct, technical skills, problem-solving abilities, and overall performance in the workplace.

- **External Evaluation (50 marks):**
    - Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period.
    - The external examiner will review the quality of students' reflections on their internship experience, their ability to apply theoretical knowledge to practical situations, and the depth of their understanding of industry practices and challenges.

The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards						
Course Code	MDM 2.5						
Course Category	Project Based Learning						
Course Title	**Mini Project**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	-	-	-		02	
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**IE**	**EE**	**Total**
	00	00		-	-	50	50	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this field project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena for Cyber Security applications.						
Course Objectives	The course teacher will 1.Facilitate application of theoretical knowledge. 2.Guide the students about enhancement of practical skills. 3.Explain about development of industry-relevant competencies.						
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets with respect to application of AI & ML.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:

- Rubric-based assessment for the project work and its report.
- Peer evaluation for project.
- Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
- Overall course grading based on a weighted average of individual assessments and participation.

The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Multidisciplinary Minor
In
Data Science

For
B.Tech (Electronics & Telecommunication Engineering)

Shivaji University, Kolhapur
Department of Technology
Multidisciplinary Minor in Data Science

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	MDM 3.1	Introduction to Data Science	03	-	-	03	03	30:70	00:00
2.		MDM 3.2	Introduction to AI and ML	03	-	-	03	03	30:70	00:00
3.		MDM 3.3	Computational Data analytics	03	-	-	03	03	30:70	00:00
4.	Program Based Internship	MDM 3.4	Data Science Related Internship	One Month			-	03	-	50:50
5.	Project Based Learning	MDM 3.5	Mini Project	-	-	-	-	02	-	50:50
				-	-	-	-	14	300	200
			Total Hours	09	00	00	09	-	-	-

Note: MDM Program's Internship and Mini Project need to be planned during winter or summer vacation days after 4th semester while respective evaluations will be the part of 7th and 8th Semesters of the B.Tech Major structure.

Year, Program, Semester	Multidisciplinary Minor III, 4th Semester onwards					
Course Code	MDM 3.1					
Course Category	Minor Program Core					
Course title	**Introduction to Data Science**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	3	-	-	3		3
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	30		70	00	00	100
Pre-requisites(if any)	Database Engineering					
Course Objectives	The Course is aimed to- 1. Provide the knowledge and expertise to become a proficient data scientist. 2.Demonstrate an understanding of statistics and machine learning concepts thatare vital for data science. 3.Produce Python code to statistically analyze a dataset. 4. Critically evaluate data visualizations based on their design and use for communicating stories from data.					
Course Outcomes	After completion of course, students would be able: 1.To explain how data is collected, managed and stored for data science. 2.To understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists. 3.To implement data collection and management scripts using MongoDB.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1												
CO 2		2	2		3		2								
CO 3				2	2	3		3							

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.	7
II	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions.).	7
III	Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, role of domain expertise, and place for imagination)- Feature Selection algorithms	9
IV	Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.	9
V	Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.	7
Text Books		
i	Business Analytics: The Science of Data - Driven Decision Making, U Dinesh Kumar, John Wiley & Sons.	
ii	Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Davy Cielen, John Wiley & Sons.	
Reference Books		
i	Joel Grus, Data Science from Scratch, Shroff Publisher/O'Reilly Publisher Media	
ii	Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher	
iii	Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher.	
iv	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.	
v	Jake VanderPlas, Python Data Science Handbook, Shroff Publisher/O'Reilly Publisher Media.	
vi	Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher/O'Reilly Publisher Media.	
Lab work		
i	Python Environment setup and Essentials.	
ii	Mathematical computing with Python (NumPy).	
iii	Scientific Computing with Python (SciPy).	
iv	Data Manipulation with Pandas.	
v	Prediction using Scikit-Learn	
vi	Data Visualization in python using matplotlib	
Assessment		

	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work.** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.

Year, Program, Semester	Multidisciplinary Minor III, 4th Semester onwards					
Course Code	MDM 3.2					
Course Category	Minor Program Core					
Course title	**Introduction to AI and ML**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	3	-	-	3		3
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	30		70	00	00	100
Pre-requisites(if any)	Database, networking, Basic Mathematics					
Course Objectives	The Course is aimed to- 1. Understand basics of machine learning in data science. 2. Understand various basic machine learning algorithm that can be used with various type of data.					
Course Outcomes	After completion of course, students would be able: 1. To explain how data is collected, managed and stored for data science. 2. To use various type of Machine learning model. 3. To implement various ML algorithms on data models.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1												
CO 2				2	2										
CO 3					2	2	2								

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Linear Regression: Basic facts of linear regression, implementation of linear regression, case studies of linear regression using data set.	6
II	Logistic Regression: Basic facts and implementation of logistic regression, solve a case study to predict output using existing data set	8
III	Clustering and Principle Component Analysis: K means and hierarchical clustering, how to make market strategies using clustering, recommendation and PCA	9
IV	Support Vector Machine: basics of SVM and use it to detect the spam emails and recognize alphabets.	8

V	Model Selection and advanced regression: use of Lasso and Ridge	8
Text Books		
i	Machine Learning using Python , U Dinesh Kumar and Manaranjan Pradhan, John Wiley & Sons.	
ii	Advanced Data Analytics Using Python: With Machine Learning, Deep Learning by By Sayan Mukhopadhyay, Apress.	
iii	Practical Data Mining" by Monte F. Hancock, Auerbach Publication.	
iv	"Machine Learning for Absolute Beginners: A Plain English Introduction (Second Edition)" by Oliver Theobald.	
Reference Books		
i	Practical Data Science with R, Nina Zumel, John Wiley & Sons	
ii	Python for Data Science for Dummies, John Paul Mueller, Luca Massaron, John Wiley	
iii	Big Data and Analytics, Seema Acharya and Subhashini Chellappan, Wiley Publication.	
Lab work		
i	Use python to predict employee attrition in a firm and help them plan their manpower. (take data set from kaggle).	
ii	Create customer clusters using different market strategies on a data set.	
iii	Make a movie recommendation system.	
iv	Develop a prediction mechanism to predict which employee can go on leave in a company in near future.	
v	Recognizing alphabets using SVM.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work.** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester	Multidisciplinary Minor III, 4th Semester onwards					
Course Code	MDM 3.3					
Course Category	Minor Program Core					
Course title	**Computational Data Analytics**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	3	-	-	3		3
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	30		70	00	00	100
Pre-requisites(if any)	Introduction to Data Science, Introduction to AI and ML					
Course Objectives	The Course is aimed to- 1. Learn how to think about your study system and research question of interest in asystematic way in order to design an efficient sampling and experimental research program. 2. Understand how to analyze collected data to derive the most information possibleabout your research questions.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Explain how data is collected, managed and stored for data science 2. When to use which type of Machine learning model. 3. Implement various ML algorithms on data models.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1												
CO 2				2	2										
CO 3					2	2	2								

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction to R Computing language. Best practices in executing Reproducible Research in data science, Sampling and Simulation. Descriptive statistics, and the creation of good observational sampling designs.	6
II	Data visualization, Data import and visualization, Introduction to various plots.	8
III	Frequentist Hypothesis Testing, Z-Tests, Power Analysis	8
IV	Linear regression, diagnostics, visualization, Likelihoodist Inference, Fitting a line with Likelihood, Model Selection with one predictor	9
V	Bayesian Inference, Fitting a line with Bayesian techniques, Multiple Regression and Interaction Effects, Information Theoretic Approaches	8
Text Books		
i	Practical Data Science with R, Nina Zumel, John Wiley & Sons.	
ii	N. C. Das, Experimental Designs in Data Science with Least Resources, Shroff Publisher Publisher..	
Reference Books		
i	Hadley Wickham, Garret Grolemund, R for Data Science, Shroff Publisher/O'Reilly Publisher Publisher	
ii	Benjamin M. Bolker. Ecological Models and Data in R. Princeton University Press, 2008. ISBN 978-0-691-12522-0.	
iii	John Fox and Sanford Weisberg. An R Companion to Applied Regression. Sage Publications, Thousand Oaks, CA, USA, second edition, 2011. ISBN 978-1-4129-7514-8.	
Lab work		
i	To give a basic insight of R and its various libraries.	
ii	Libraries in R. R as a Data Importing Tool, Dplyr. Forcats.	
iii	Simulation and Frequentist Hypothesis testing, Simulation and Power.	
iv	Bayesian computation in R, Fitting a line with Bayesian techniques.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work.** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">Multidisciplinary Minor III, 4th Semester onwards</td></tr>
<tr><td>Course Code</td><td colspan="7">MDM 3.4</td></tr>
<tr><td>Course Category</td><td colspan="7">Program Based Internship</td></tr>
<tr><td>Course Title</td><td colspan="7">Data Science Related Internship</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td colspan="4">One Month</td><td colspan="2">03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td colspan="2">ESE</td><td>IOE</td><td>IPE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">00</td><td colspan="2">00</td><td>-</td><td>-</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Basics of unit processes and unit operations.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The course caters specifically to B.Tech Electronics & Telecommunication Engineering students as the part of multidisciplinary Minor with respect to Data science applications. This course offers practical exposure to industry settings aligned with their chosen discipline, aiming to bridge the gap between theoretical knowledge and practical application. By engaging in a one-month internship, students gain firsthand experience, essential skills, and insights crucial for their future careers in additional sector of industry.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course teacher will
1. Help expose students to the 'real' working environment;
2.Promote hands-on experience to the students’ in their related field;
3.Develop synergetic collaboration between industry and the university in promoting a knowledgeable society;
4.Assist in providing the opportunity for students to test their interest in a particular career before permanent commitments are made.
5.Elaborate the dynamic and challenging nature of industrial environments.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to
1.Understand industrial processes and operations related to their minor sub-specializations.
2.Apply theoretical concepts to solve practical problems in the industry.
3.Communicate effectively with industry professionals, colleagues, and supervisors.
4.Collaborate efficiently in team environments to complete tasks and projects.
5.Adapt to the dynamic and challenging nature of industrial environments.
6.Reflect on internship experiences for personal and professional growth.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	-	-	-	-	-	-	-	-	3	-	-	-
CO 5	-	-	-	-	-	2	-	-	-	-	-	3
CO 6	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	**Hours**
The course consists of a one-month internship with respect to applications of Data Science . Students will be placed in companies or organizations that align with the particular requirement. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2.Assisting with ongoing projects or research initiatives within the organization. 3.Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4.Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5.Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6.Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

Course Evaluation Method

This particular evaluation will be the part of the structure of 7th Semester.

The evaluation for the Industrial Internship course will be conducted as follows:

- **Internal Evaluation (50 marks):**
  - Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks.
  - Evaluation by industrial supervisors on students' professional conduct, technical skills,

problem-solving abilities, and overall performance in the workplace.

- **External Evaluation (50 marks):**
    - Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period.
    - The external examiner will review the quality of students' reflections on their internship experience, their ability to apply theoretical knowledge to practical situations, and the depth of their understanding of industry practices and challenges.

The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.

Year, Program, Semester	Multidisciplinary Minor III, 4th Semester onwards						
Course Code	MDM 3.5						
Course Category	Project Based Learning						
Course Title	**Mini Project**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	-	-	-		02	
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**IE**	**EE**	**Total**
	00	00		-	-	50	50	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this field project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena for Data science applications.						
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2.Guide the students about enhancement of practical skills. 3.Explain about development of industry-relevant competencies.						
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets with respect to application of AI & ML.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:

- Rubric-based assessment for the project work and its report.
- Peer evaluation for project.
- Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
- Overall course grading based on a weighted average of individual assessments and participation.

The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Shivaji University Vidyanagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Pool of Specialization Minors for MDM Featured B. Tech (Electronics and Telecommunication Engineering), Detailed Curriculum

Specialization Minor
In
VLSI Design
For
B.Tech (Electronics and Telecommunication Engineering)

Shivaji University, Kolhapur
Department of Technology

Specialization Minor in VLSI Design

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	SPM 1.1	VHDL Programming	03	-	-	03	03	30:70	00:00
2.		SPM 1.2	Verilog Programming	03	-	-	03	03	30:70	00:00
3.		SPM1.3	VLSI Design	03	-	-	03	03	30:70	00:00
4.	Minor Program Based Internship	SPM1.4	Internship	One Month				03	00:00	50:50
5.	Project Based Learning	SPM 1.5	Mini Project	-	-	-	-	02	-	50:50
				-	-	-	-	14	300	200
			Total Hours	09	00	00	09	-	-	-

Note: If opted the Specialization Minor Program, Internship may be planned during winter or summer vacation days after 4th semester while respective evaluations will appear on a separate mark sheet.

Year, Program, Semester	Specialization Minor I, 4th Semester onwards				
Course Code	SPM-1.1				
Course Category	Specialization Minor Program Core				
Course title	VHDL Programming				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**ISE:30**			**ESE: 70**	**Total=100**
Pre-requisites (if any)	Prerequisites for this course typically include a solid background in digital electronics				
Course Rationale	The course provides a comprehensive introduction to the core principles and concepts of VLSI Design. It aims to equip students with the foundational knowledge and skills necessary to program and design the VLSI systems.				
Course Objectives	The students will learn 1. VHDL entity and architecture 2. Behavioral modeling 3. Sequential Processing 4. Data types 5. Subprograms and packages 6. VHDL coding				
Course Outcomes	The students will be able to 1. Create the VHDL program for circuit design 2. Model the behaviour of the system 3. Write the program for sequential processing 4. Describe the data types in VHDL 5. Explain the subprogram and packages 6. Write VHDL code and simulate the circuit				

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1									3	2
CO2	3	2	3	3									2	2
CO3	3	2	3	3	3									
CO4	3	1	3	3										
CO5	3	3		1										
CO6	3	2	3	3	3						3	3		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	**Introduction to VHDL** HDL, Entity , Architectures ,Concurrent Signal Assignment , Event Scheduling 6 Statement Concurrency , Structural Designs , Sequential Behavior , Process Statements , Process Declarative Region ,Process Statement Part , Process Execution , Sequential Statements , Architecture Selection , Configuration Statements , Power of Configurations ,	06
2.	**Behavioral Modeling** Introduction to Behavioral Modeling , Transport Versus Inertial Delay , Inertial Delay , Transport Delay 21 Inertial Delay Model , Transport Delay Model , Simulation Deltas , Drivers , Driver Creation , Bad Multiple Driver Model , Generics , Block Statements , Guarded Blocks	06
3.	**Sequential Processing** Process Statement Sensitivity List , Process Example , Signal Assignment Versus Variable Assignment , Incorrect Mux Example , Correct Mux Example , Sequential Statements , IF Statements , CASE Statements , LOOP Statements , NEXT Statement , EXIT Statement , ASSERT Statement , Assertion BNF , WAIT Statements , WAIT ON Signal , WAIT UNTIL Expression , WAIT FOR time_expression , Multiple WAIT Conditions , WAIT Time-Out , Sensitivity List Versus WAIT Statement 66 Concurrent Assignment Problem , Passive Processes	06
4.	**Data Types** Object Types , Signal , Variables , Constants , Data Types , Scalar Types , Composite Types , Incomplete Types , File Types , File Type Caveats , Subtypes	06
5.	**Subprograms and Packages** Subprograms , Function , Conversion Functions , Resolution Functions , Procedures , Packages , Package Declaration , Deferred Constants , Subprogram Declaration , Package Body	06
6.	**Laboratory work / minor project work** VHDL programming based simulation project or experiments to be conducted in Laboratory , Designing basic gates, combinational circuit, designing general purpose processor, datapath, ALU, encoder, decoder, comparator, adder, subtractor, multiplexer, de-multiplexer, tri-state drivers, PIPO, SIPO, sequential circuits	06

Sr. No.	Reference Books
1.	Douglas L. Perry, " VHDL Programming by Example", McGraw Hill
2.	Gaganpreet Kaur, "VHDL Basics to Programming", Pearson

Sr. No.	Important web links
1.	Relevant to the course matter

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Specialization Minor IV, 4th Semester onwards</td></tr>
<tr><td>Course Code</td><td colspan="5">SPM-1.2</td></tr>
<tr><td>Course Category</td><td colspan="5">Specialization Minor Program Core</td></tr>
<tr><td>Course title</td><td colspan="5">Verilog Programming</td></tr>
<tr><td rowspan="3">ching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3">ISE:30</td><td>ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Prerequisites for this course typically include a solid background in digital electronics</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course provides a comprehensive introduction to the core principles and concepts of VLSI Design. It aims to equip students with the foundational knowledge and skills necessary to program and design the VLSI systems.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The students will learn
1. Verilog modules
2. Basics of Verilog
3. Gate level modeling
4. Data flow modeling
5. Behavioral modelling
6. Verilog coding and simulation</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">The students will be able to
1. Illustrate the fundamentals of Verilog
2. Create the Verilog program for circuit design
3. Describe the gate level modeling
4. Describe the data flow modeling
5. Explain behavioural modeling
6. Write Verilog code and simulate the circuit</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1									3	2
CO2	3	2	3	3									2	2
CO3	3	2	3	3	3									
CO4	3	1	3	3										
CO5	3	3		1										
CO6	3	2	3	3	3						3	3		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Digital design with Verilog** HDL HDL importance, HDL design flow, Hierarchical modelling, Design methodologies, modules, instances, examples	06
2	**Basic concepts** Lexical conventions, Number representations, Data types, system tasks and compiler directives, examples	06
3	**Modules , gate level modeling ports** Modules , ports, hierarchical names, gate types ,gate delays	06
4	**Dataflow modeling** Continues assignment , Delays, Expressions , operators, operands, operator types, examples	06
5	**Behavioral modelling** Structured procedures, Procedural assignments, timing controls, conditional statements, multiway statements, multiway branching, loops, sequential and parallel blocks, generate blocks, examples	06
6	**Laboratory work / minor project work** Verilog programming based simulation project or experiments to be conducted in Laboratory, Designing basic gates, combinational circuit, designing general purpose processor, datapath, ALU, encoder, decoder, comparator, adder, subtractor, multiplexer, de-multiplexer, tri-state drivers, PIPO, SIPO, sequential circuits	06
Sr. No.	**Reference Books**	
1	Samir Palnitkar , " Verilog HDL", Pearson	
2	Thomas, "The verilog hardware description language", Springer	
Sr. No.	**Important web links**	
1	Relevant to the course matter	

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards				
Course Code	SPM-1.3				
Course Category	Specialization Minor Program Core				
Course title	**VLSI Design**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**ISE:30**			**ESE: 70**	**Total=100**
Pre-requisites (if any)	Prerequisites for this course typically include a solid background in digital electronics				
Course Rationale	The course provides a comprehensive introduction to the core principles and concepts of VLSI Design. It aims to equip students with the foundational knowledge and skills necessary to program and design the VLSI systems.				
Course Objectives	The students will learn 1. VLSI design methodology 2. MOS Devices 3. CMOS IC fabrication 4. Architecture of CPLD and FPGA 5. IC design flow 6. CPLD and FPGA based design				
Course Outcomes	The students will be able to 1. Describe the VLSI design methodology 2. Realize the MOS transistor based digital circuits 3. Describe the CMOS IC fabrication Technology 4. Explain the architecture of CPLD and FPGA 5. Explain the IC design flow 6. Complete laboratory work and minor project				

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1									3	2
CO2	3	2	3	3									2	2
CO3	3	2	3	3	3									
CO4	3	1	3	3										
CO5	3	3		1										
CO6	3	2	3	3	3						3	3		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**VLSI Design Methodology** Introduction, layers of abstraction, Technology trends and design styles	06
2	**MOS Devices** Introduction to MOS Technology, I – V Characteristics of NMOS and PMOS, Transfer Characteristics Of CMOS Inverter, Detailed analysis of CMOS inverter, Logic realization using nMOS and CMOS circuits, effect of parasitic elements.	06
3	**CMOS IC Fabrication and Layout** Basic CMOS Technology: Self aligned CMOS process, fabrication Techniques, Fabrication processes, N well, P well, Twin tub, Layout of CMOS Inverter, CMOS Layout and Design rules. Silicon on Insulator technology	06
4	**Circuit Design Using CPLD & FPGA** Introduction, study of basic architecture of CPLDs and FPGAs. Case studies – CPLD and FPGA	06
5	**IC design flow** Logic synthesis, floor-planning, synthesis, block level layout, IC level layout, latest trends in IC design	06
6	**Laboratory work / minor project work** CPLD / FPGA based minor project : concept to implementation or the laboratory work based on syllabus	06

Sr. No.	Reference Books
1	N. Weste and K. Eshranghian, "Principles of CMOS VLSI Design", Addison Wesley
2	Angsuman Sarkar, Swapnadip De, Ckandan Kumar Sarkar, "VLSI Design and EDA tools", Scitech
3	Amar Mukharjee, "Introduction to nMOS and cMOS VLSI systems design", Prentice Hall
4	Stephen Brown and Zvonko, " Vranesic, "Fundamentals of Digital Logic with VHDL design", Tata McGraw Hill
5	BushnellAgrawal , "Essentials of Electronic Testing for digital memory and mixed signal VLSI circuits", Kulwar Academic Publisher
Sr. No.	**Important web links**
1	Relevant to the course matter

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards				
Course Code	SPM-1.4				
Course Category	Program Based Internship				
Course title	Internship				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**IE:50**		**EE: 50**	**Total=100**	
Pre-requisites (if any)	Prerequisites for this course typically include a solid background in digital electronics, HDL, VLSI Design				
Pre-requisites (if any)	Prerequisites for this course typically include a solid background in digital electronics, HDL, VLSI Design				
Course Rationale	The course provides a comprehensive introduction to the core principles and concepts of VLSI Design. It aims to equip students with the foundational knowledge and skills necessary to program and design the VLSI systems.				
Course Objectives	The students will learn 1. To expose students to real working environment and get acquainted with the organization structure, business operations and administrative functions 2. To have hands on experience in the related field to get exposure with the industrial trend 3. To promote cooperation and to develop synergetic collaboration between industry and the university 4. To set the step for future recruitment 5. Get familiarity with professional skills 6. Understand the information required for entrepreneurship				
Course Outcomes	The students will be able to 1. Know the industrial working environment 2. Utilize the technical resources 3. Write technical documents and appear for interview / power point presentations/ technical discussions 4. Develop attitude of a team player and ability of life-long learning 5. Adapt and develop professional skills required for employability 6. Motivation for entrepreneurship				

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1									3	2
CO2	3	2	3	3									2	2
CO3	3	2	3	3	3									
CO4	3	1	3	3										

CO5	3	3		1										
CO6	3	2	3	3	3						3	3		

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Duration
1	Four-week industrial training in a reputed industry from stand point view of VLSI Design - electronics engineering is mandatory. Students should learn and understand the concepts of VLSI system design, industrial organization and management. They should get familiarity with different departments like R & D, production, quality, purchase, sales & marketing and other. Students should submit detail report in the given format to the B.Tech Electronics & Telecommunication Engineering program in which all details of internship must be included. Panel of faculty members appointed by the program coordinator will assess the individual student.	**4 week**
Sr. No.	**Reference Books**	
1	Articles from reputed journals, magazines, websites, real world problems, case studies, Survey reports	
2	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.	
Sr. No.	**Important web links**	
1	As per requirement	

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards							
Course Code	SPM 1.5							
Course Category	Project Based Learning							
Course Title	**Mini Project**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	-	-	-	-		02		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**IE**	**EE**	**Total**
	00	00		--	-	50	50	100
Pre-requisites(if any)	Basics of unit processes and unit operations.							
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this mini project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena in green aspects of Industry.							
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.							
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.							

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Specialization Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets pertaining to application of Green Technology.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process
This particular evaluation will be the part of 8th Semester of the major structure. The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work. The teachers will follow the instructions as below: Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including: • Rubric-based assessment for the project work and its report. • Peer evaluation for project. • Instructor-led discussions or presentations to evaluate communication skills and critical thinking. • Overall course grading based on a weighted average of individual assessments and participation. The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Specialization Minor
in
Advanced Communication Engineering
For
B.Tech (Electronics and Telecommunication Engineering)

Shivaji University, Kolhapur

Department of Technology

Specialization Minor in Advanced Communication Engineering

Teaching & Evaluation Scheme										
Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	SPM 2.1	5 G Communication	03	-	-	03	03	30:70	00:00
2.		SPM 2.2	Antennas for Advanced Communication	03	-	-	03	03	30:70	00:00
3.		SPM2.3	RF Circuit Design	03	-	-	03	03	30:70	00:00
4.	Minor Program Based Internship	SPM2.4	Internship	One Month				03	00:00	50:50
5.	Project Based Learning	SPM 2.5	Mini Project	-	-	-	-	02	-	50:50
				-	-	-	-	14	300	200
			Total Hours	09	00	00	09	-	-	-

Note: If opted the Specialization Minor Program, Internship may be planned during winter or summer vacation days after 4th semester while respective evaluations will appear on a separate mark sheet.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Specialization Minor IV, 4th Semester onwards</td></tr>
<tr><td>Course Code</td><td colspan="5">SPM-2.1</td></tr>
<tr><td>Course Category</td><td colspan="5">Specialization Minor Program Core</td></tr>
<tr><td>Course title</td><td colspan="5">5 G Communication</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Computer Network</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The rapid evolution of mobile communication technologies has reached the fifth generation (5G), which promises to revolutionize connectivity and enable a new wave of technological innovations. As industries and societies increasingly rely on wireless communication for critical applications, there is a growing demand for engineers who are well-versed in 5G technologies. This course is designed to provide undergraduate engineering students with comprehensive knowledge and practical skills in 5G communication, preparing them for careers in this cutting-edge field.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Explain the evolution and key advancements in mobile networks from 1G to 5G.
2. Understand the architecture of the 5G Core Network (5GC) and the 5G Radio Access Network (RAN).
3. Explore the key radio technologies that enable 5G communication.
4. Understand the protocols and procedures of the 5G NR physical and MAC layers.
5. Identify the security and privacy challenges in 5G networks and the solutions to address them.</td></tr>
</table>

	6. Analyse the deployment strategies and future trends of 5G technology.
Course Outcomes	**The students will be able to** 1. Describe the technological improvements and key features that differentiate each generation of mobile networks, from 1G to 5G. 2. Illustrate the architecture of 5GC and compare it with LTE RAN. 3. Analyze the role of spectrum allocation, Massive MIMO, beamforming, OFDM, and duplexing techniques in 5G. 4. Explain the functions and interactions of the physical layer, MAC layer. 5. Evaluate the security architecture of 5G, including authentication, key management, network security, and privacy mechanisms. 6. Discuss the differences between SA and NSA deployments, the role of 5G in IoT and Industry 4.0, emerging technologies in 5G, and the potential features and technologies of 6G.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO 1	3	2	2							2			3	2
CO 2	3	3	3							2			2	2
CO 3	3	3	3	2						2				
CO 4	3	3	3	2						2				
CO5	3	3	3	2		2		2		2	2			
CO6	3	3	3	2		2		2		2	2			

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	**Introduction to 5G Technology** Evolution of Mobile Networks (1G to 5G) • Overview of cellular technology evolution • Key differences and improvements in each generation	**04**

	5G Vision and Requirements • ITU 5G requirements • Enhanced Mobile Broadband (eMBB), Ultra-Reliable Low-Latency Communications (URLLC), Massive Machine Type Communications (mMTC) Standards and Regulatory Aspects • Overview of 5G standards • Regulatory challenges and considerations 5G Use Cases and Applications • Smart cities, autonomous vehicles, IoT • Industry applications and future trends 5G Ecosystem and Stakeholders • Key players in the 5G ecosystem • Roles of different industries and regulators	
2.	**5G Network Architecture** 5G Core Network Architecture : • Overview of 5G Core (5GC) architecture • Network functions and service-based architecture 5G Radio Access Network (RAN) : • NR (New Radio) architecture • Comparison with LTE RAN Network Slicing : • Concept of network slicing • Implementation and use cases	**07**

	Edge Computing in 5G : • Mobile Edge Computing (MEC) concepts • Benefits and challenges in 5G Cloud-Native 5G : • Principles of cloud-native architecture • Benefits for 5G deployment	
3.	**5G Radio Technologies** Spectrum for 5G : • Spectrum allocation and management • Millimeter wave (mmWave) frequencies Massive MIMO and Beamforming : • Introduction to Massive MIMO • Beamforming techniques and benefits OFDM and Waveform Design : • Orthogonal Frequency Division Multiplexing (OFDM) in 5G • Other waveform candidates Duplexing Techniques : • Time Division Duplex (TDD) and Frequency Division Duplex (FDD) • Hybrid and flexible duplexing	**07**
4.	**5G Protocols and Procedures** 5G NR Physical Layer • Physical channels and signals • NR frame structure	**07**

	MAC Layer in 5G NR • Medium Access Control (MAC) layer functions • Scheduling and resource allocation RLC and PDCP Layers • Radio Link Control (RLC) layer • Packet Data Convergence Protocol (PDCP) layer RRC and NAS Protocols • Radio Resource Control (RRC) layer • Non-Access Stratum (NAS) procedures	
5.	**5G Security and Privacy** Overview of 5G Security • Security challenges in 5G • Security architecture and principles Authentication and Key Management • 5G authentication procedures • Key management in 5G Network and Data Security • Securing the 5G core and RAN • Data protection techniques Privacy in 5G • Privacy concerns and requirements • Mechanisms to ensure user privacy	**05**
6.	**5G Implementation and Future Trends**	**06**

	5G Deployment Strategies • Standalone (SA) vs. Non-Standalone (NSA) deployment • Deployment challenges and solutions 5G in IoT and Industry 4.0 • Role of 5G in IoT • Industrial automation and Industry 4.0 Emerging Technologies in 5G • Artificial Intelligence (AI) and Machine Learning (ML) in 5G • Quantum communication and blockchain in 5G networks 5G Testing and Optimization • Testing methodologies for 5G networks • Network optimization techniques Simulation Tools for 5G • Introduction to 5G simulation tools (e.g., MATLAB, NS-3) Case Studies • Review of real-world 5G case studies Future Trends and 6G Vision • Early concepts of 6G • Potential features and technologies	

Sr. No.	**Reference Books**
1.	5G Mobile and Wireless Communications Technology -Afif Osseiran, Jose F. Monserrat, Patrick Marsch - Cambridge University Press

2.	5G NR: The Next Generation Wireless Access Technology -Erik Dahlman, Stefan Parkvall, Johan Sko¨ld - Elsevier
3.	Fundamentals of 5G Mobile Networks, Jonathan Rodriguez,Wiley
Sr. No.	**Important web links**
1.	NPTEL https://nptel.ac.in/courses/108/105/108105134/
2.	Udemy https://www.udemy.com/course/5g-mobile-networks-modern-wireless-communication-technology/

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards				
Course Code	SPM-2.2				
Course Category	Specialization Minor Program Core				
Course title	**Antennas for Advanced Communication**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**ISE:30**			**ESE: 70**	**Total=100**
Pre-requisites (if any)	Electromagnetic Engineering				
Course Rationale	This course provides a comprehensive foundation for understanding and designing microstrip antennas (MSAs), which are essential components in modern wireless communication systems.				
Course Objectives	1. Understand fundamental concepts and applications of Microstrip Antennas (MSAs). 2. Explore various feeding techniques and analysis methods for MSAs. 3. Develop proficiency in the design and optimization of Rectangular Microstrip Antennas. 4. Gain expertise in the design and optimization of Circular Microstrip Antennas. 5. Investigate compact, broadband, and metamaterial techniques for MSAs. 6. Examine advanced topics and emerging applications of MSAs.				
Course Outcomes	1. Explain types, characteristics, and applications of MSAs. 2. Analyze feeding techniques and different methods for MSA analysis. 3. Design RMSAs considering parametric variations and higher-order modes 4. Evaluate design considerations and perform parametric studies on CMSAs 5. Develop compact and broadband MSAs using advanced techniques. 6. Integrate MSAs with modern RF systems and explore new applications.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3												2	3
CO 2	3	2	2										3	3
CO 3	3	3	3	2	3									
CO 4	3	3	3	2	3									
CO 5	3	3	2		3									
CO 6	3	3	2			2								

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	**Introduction to Microstrip Antennas** Overview of Microstrip Antennas (MSAs), Types and Characteristics of MSAs, Advantages and Disadvantages of MSAs, Applications of MSAs **Key Parameters:** Reflection Coefficient, VSWR, Return Loss, Impedance Mismatch **Performance Metrics:** VSWR Bandwidth, Gain, Directivity, Efficiency, Radiation Patterns, Polarization: Co and Cross Polarization, Specific Absorption Rate (SAR), Axial Ratio	**06**
2.	**Feeding Techniques and Analysis Methods** Overview of Feeding Techniques (Microstrip Line, Coaxial Probe, Aperture Coupled, Proximity Coupled), Surface Waves and their Effects, Substrates for MSAs and Dielectric Constants Methods of Analysis: Transmission Line Model, Cavity Model, Methods of Analysis: Full-Wave Model, Hybrid Techniques	**05**
3.	**Design of Rectangular Microstrip Antennas (RMSA)** Design Considerations: Resonant Frequency, Voltage, and Current Variation, Radiation Pattern , Effective Dielectric Constant, Calculation of Actual and Effective Length, Width, , **Parametric Study:** Effect of - Feed Point Location, Width, Substrate Height, Dielectric Constant, Probe Diameter, Finite Ground Plane, Loss Tangent. Analysis of Higher Order Modes in RMSA	**07**
4.	**Design of Circular Microstrip Antennas (CMSA)** Design Considerations: Resonant Frequency, Input Impedance, Voltage Distribution Radiation Pattern, Effective Dielectric Constant, Calculation of Effective Radius, Feed Point Location Determination, **Parametric Study:** Effect of Feed Point Location, Loss Tangent. Analysis of Higher Order Modes in CMSA	**06**
5.	**Compact, Broadband, and Metamaterial Techniques** Techniques for Compact RMSA and CMSA: Compact Shorted RMSA, Partially Shorted RMSA, Effect of Dimensions on RMSA with a Single Shorting Post, Positioning and Impact of Single Shorting Post, Broadband Techniques: Introduction and Overview	**06**

Sr. No.	Reference Books
1.	Girish Kumar, K.P. Ray Broadband Microstrip Antennas Artech House Publishers
2.	"Microstrip Antenna Design Handbook" by Ramesh Garg, Prakash Bhartia, Inder Bahl, and Apisak Ittipiboon, published by Artech House.

3.	"Antenna Theory: Analysis and Design" by Constantine A. Balanis, published by Wiley.
4.	"Microstrip Patch Antennas: A Designer's Guide" by Kin-Lu Wong, published by Springer.
5.	"Microstrip Antenna Design" by David M. Pozar, published by Pearson Education.
Sr. No.	**Important web links**
1.	https://archive.nptel.ac.in/courses/108/101/108101092/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Specialization Minor IV, 4th Semester onwards</td></tr>
<tr><td>Course Code</td><td colspan="5">SPM-2.3</td></tr>
<tr><td>Course Category</td><td colspan="5">Specialization Minor Program Core</td></tr>
<tr><td>Course title</td><td colspan="5">RF Circuit Design</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3">ISE:30</td><td>ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Electronic circuit Design</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with study of RF design issues, study of RF components,design of RF filters, coupled filters, amplifiers, mixers and oscillators.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">Students will be able to:
1. Introduce students about RF design issues.
2. Compare RF filter types and parameters.
3. Analyse RF Coupled filters.
4. Evaluate active RF component characteristics.
5. Analyse RF amplifier stability.
6. Understand oscillators, mixers, and PLLs</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Students will be able to:
1. Explain RF design significance in communication.
2. Design various RF filters for specific responses.
3. Implement coupled filters in RF applications.
4. Discuss different RF components and their applications.
5. Design stable RF amplifiers considering power and noise.
6. Design RF oscillators, mixers for specific applications.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	1									3	3
CO 2	3	2	3	3									2	2
CO 3	3	2	2	3	3									
CO 4	3	1	3	3										
CO 5	3	2		1										
CO 6	3	2	2	3	3									

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**RF ISSUES** Importance of RF design, Electromagnetic Spectrum, RF behaviour of passive components, Chip components and Circuit Board considerations, Scattering Parameters, Smith Chart and applications	06
2	**RF FILTER DESIGN** Filter types and parameters, Low pass filter, High pass filter, Bandpass and Band stop filter, Insertion Loss. Special Filter Realizations: Butterworth type filter, Chebyshev type filters, Denormalization of standard low pass design.	06
3	**COUPLED FILTERS** Odd and Even Mode Excitation, Bandpass Filter Design, Cascading band pass filter elements, Design examples.	06
4	**ACTIVE RF COMPONENTS & APPLICATIONS**	06

	RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks –Impedance matching using discrete components, Micro strip line matching networks, Amplifier classes of operation and biasing networks.	
5	**RF AMPLIFIER** Characteristics, Amplifier power relations, Stability considerations, Constant gain Circles, Constant VSWR circles, Low Noise circuits, high power and multistage amplifiers.	**06**
6	**OSCILLATORS AND MIXERS** Basic Oscillator model, High frequency oscillator configuration, Balanced modulators, Basic characteristics of Mixers, Phase Locked Loops, RF directional couplers and hybrid couplers, Detector and demodulator circuits.	**06**

Sr. No.	**Reference Books**
1	Reinhold Ludwig and Powel Bretchko, RF Circuit Design, Theory and Applications, Pearson Education Asia, First Edition, 2001.
2	James Hardy, "High Frequency Circuit Design ", Resto Publishing Co., NewYork,
3	Joseph. J. Carr, Secrets of RF Circuit Design, McGraw Hill Publishers, Third Edition, 2000.
4	Mathew M. Radmanesh, Radio Frequency & Microwave Electronics, Pearson Education Asia, Second Edition, 2002.
5	Ulrich L. Rohde and David P. NewKirk, RF / Microwave Circuit Design, John Wiley & Sons USA 2000.

Sr. No.	**Important web links**
1	https://archive.nptel.ac.in/courses/108/101/108101112/

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards				
Course Code	SPM-2.4				
Course Category	Program Based Internship				
Course title	Internship				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	-	-	-	--	03
Evaluation Scheme	**IE:50**		**EE: 50**	**Total=100**	
Pre-requisites (if any)	Prerequisites for this course typically include a solid background in Analog & Digital Electronics, Communication Engineering				
Course Rationale	An internship in Advanced Communication Engineering allows students to apply theoretical knowledge in real-world scenarios, enhancing their technical skills and understanding of current industry trends. This experience bridges the gap between academic learning and professional practice, preparing students for successful careers in the field.				
Course Objectives	The students will learn 1. To expose students to real working environment and get acquainted with the organization structure, business operations and administrative functions 2. To have hands on experience in the related field to get exposure with the industrial trend 3. To promote cooperation and to develop synergetic collaboration between industry and the university 4. To set the step for future recruitment 5. Get familiarity with professional skills 6. Understand the information required for entrepreneurship				
Course Outcomes	The students will be able to 1. Know the industrial working environment 2. Utilize the technical resources 3. Write technical documents and appear for interview / power point presentations/ technical discussions 4. Develop attitude of a team player and ability of life-long learning 5. Adapt and develop professional skills required for employability 6. Motivation for entrepreneurship				

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1									3	2
CO2	3	2	3	3									2	2
CO3	3	2	3	3	3									
CO4	3	1	3	3										
CO5	3	3		1										
CO6	3	2	3	3	3						3	3		

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	**Course Content**	**Duration**
1	Four-week industrial training in a reputed industry from stand point view of Communication Engineering is mandatory. Students should learn and understand the concepts of system design, industrial organization and management. They should get familiarity with different departments like R & D, production, quality, purchase, sales & marketing and other. Students should submit detail report in the given format to the B.Tech Electronics & Telecommunication Engineering program in which all details of internship must be included. Panel of faculty members appointed by the program coordinator will assess the individual student.	**4 week**
Sr. No.	**Reference Books**	
1	Articles from reputed journals, magazines, websites, real world problems, case studies, Survey reports	
2	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.	
Sr. No.	**Important web links**	
1	As per requirement	

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards						
Course Code	SPM 2.5						
Course Category	Project Based Learning						
Course Title	**Mini Project**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	-	-	-		02	
Evaluation Scheme	**ISE**	**ESE**	**IOE**	**IPE**	**IE**	**EE**	**Total**
	00	00	-	-	50	50	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this mini project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena in green aspects of Industry.						
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.						
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content
Specialization Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and

develop versatile skill sets pertaining to application of Green Technology.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:

- Rubric-based assessment for the project work and its report.
- Peer evaluation for project.
- Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
- Overall course grading based on a weighted average of individual assessments and participation.

The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Specialization Minor
in
Computer Networking
For
B. Tech (Electronics and Telecommunication Engineering)

Shivaji University, Kolhapur

Department of Technology

Specialization Minor in Computer Networking

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	SPM 3.1	Network Security	03	-	-	03	03	30:70	00:00
2.		SPM 3.2	Advanced Network Architectures	03	-	-	03	03	30:70	00:00
3.		SPM3.3	Wireless Networking Technologies	03	-	-	03	03	30:70	00:00
4.	Minor Program Based Internship	SPM3.4	Internship	One Month				03	00:00	50:50
5.	Project Based Learning	SPM 3.5	Mini Project	-	-	-	-	02	-	50:50
				-	-	-	-	14	300	200
			Total Hours	09	00	00	09	-	-	-

Note: If opted the Specialization Minor Program, Internship may be planned during winter or summer vacation days after 4th semester while respective evaluations will appear on a separate mark sheet.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Specialization Minor IV, 4th Semester onwards</td></tr>
<tr><td>Course Code</td><td colspan="5">SPM-3.1</td></tr>
<tr><td>Course Category</td><td colspan="5">Specialization Minor Program Core</td></tr>
<tr><td>Course title</td><td colspan="5">Network Security</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>02</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Computer Network</td></tr>
<tr><td>Course Rationale</td><td colspan="5">In today's digital world, network security is vital for protecting sensitive information and ensuring trust in digital transactions. This course provides essential knowledge and skills to defend against cyber threats, safeguarding the integrity and confidentiality of networked data.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Understand basic network security concepts.
2. Understand and apply encryption techniques to secure data.
3. Explore protocols that secure network communication.
4. Implement methods to control network access securely.
5. Detect and prevent unauthorized access to networks.
6. Explore new trends and technologies in network security.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Recognize different types of network attacks.
2. Apply encryption techniques to protect data.
3. Configure secure communication channels using protocols.
4. Manage user access to network resources effectively.
5. Respond to security incidents and breaches promptly.
6. Analyze and propose solutions for emerging security challenges.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO 1	3	3											3	3
CO 2	3	3											3	3
CO 3		3	3											
CO 4			3		2									
CO5				3	3									
CO6						2	2					3		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	**Introduction to Network Security** Overview of Network Security, Security Goals and Principles, Threats and Vulnerabilities, Types of Attacks (Passive and Active), Security Models and Architectures, Case Studies on Network Breaches	05
2.	**Cryptography Fundamentals** Basic Concepts of Cryptography, Symmetric Key Cryptography, Asymmetric Key Cryptography, Cryptographic Protocols, Digital Signatures, Public Key Infrastructure (PKI)	06
3.	**Network Security Protocols** Secure Sockets Layer (SSL) and Transport Layer Security (TLS),IP Security (IPsec),Secure Shell (SSH), Wireless Security Protocols (WPA, WPA2), Virtual Private Networks (VPNs), Case Studies on Security Protocols	07
4.	**Network Access Control and Authentication** Authentication Methods, Access Control Mechanisms, Role-Based Access Control (RBAC), Single Sign-On (SSO) Solutions, Multi-Factor Authentication (MFA), Case Studies on Authentication Failures	07
5.	**Intrusion Detection and Prevention** Intrusion Detection Systems (IDS), Intrusion Prevention Systems (IPS),Host-Based vs. Network-Based IDS/IPS, Signature-Based and Anomaly-Based Detection, Incident Response and Management, Case Studies on Intrusion Detection	06
6.	**Advanced Topics in Network Security**	05

	Advanced Persistent Threats (APTs), Cyber Forensics and Investigation, Security in Cloud Computing, Block chain and Network Security, Emerging Trends in Network Security	

Sr. No.	**Reference Books**
1.	“Network Security Essentials: Applications and Standards" by William Stallings, Publisher: Pearson
2.	"Cryptography and Network Security: Principles and Practice" by William Stallings, Publisher: Pearson
3.	"Network Security: Private Communication in a Public World" by Charlie Kaufman, Radia Perlman, and Mike Speciner, Publisher: Pearson
4.	"Network Security: A Beginner's Guide" by Eric Maiwald, Publisher: McGraw-Hill Education
5.	"Cybersecurity for Beginners" by Raef Meeuwisse, Publisher: Kogan Page
6.	"Firewalls and Internet Security: Repelling the Wily Hacker" by William R. Cheswick, Steven M. Bellovin, and Aviel D. Rubin,Publisher: Addison-Wesley Professional
7.	“Cybersecurity: The Essential Guide” S.B.Gaikwad, K.G.Kharade, Rashmi Agrawal, R.K.Kamat, by Pacific Books International, ISBN 978-93-92469-11-4
Sr. No.	**Important web links**
1.	As per requirement

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards				
Course Code	SPM-3.2				
Course Category	Specialization Minor Program Core				
Course title	**Advanced Network Architectures**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**ISE:30**			**ESE: 70**	**Total=100**
Pre-requisites (if any)	Computer Network				
Course Rationale	The rapid evolution of network technologies demands a deep understanding of advanced network architectures. This course explores modern frameworks such as Software-Defined Networking (SDN), Network Function Virtualization (NFV), data center networking, and IoT networking, providing students with the skills to design and manage cutting-edge network solutions.				
Course Objectives	1. Understand traditional and modern network architectures. 2. Understand the principles and architecture of Software-Defined Networking (SDN). 3. Comprehend NFV and its integration with SDN. 4. Explore data center network architectures and virtualization. 5. Analyze security challenges in IoT networks. 6. Explore future trends in network architectures.				
Course Outcomes	1. Differentiate traditional and modern network architectures. 2. Describe the architecture, components, and principles of SDN. 3. Illustrate how NFV integrates with SDN. 4. Design network solutions for data centers. 5. Analyze security challenges in IoT networks. 6. Evaluate future trends and their impact on network architectures				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO 1	3	3											3	3
CO 2	3	3											2	3
CO 3	3	3	2											
CO 4	3		3		2									
CO5		3		3	2		3							
CO6			3			2	2					3		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	**Chapter 1: Introduction to Network Architectures** Overview of Network Architectures, Traditional vs. Modern Network Architectures, Layered Architectures and Protocol Stacks, OSI Model vs. TCP/IP Model, Case Studies on Network Architectures, Review of Basic Network Architectures.	05
2.	**Chapter 2: Software-Defined Networking (SDN)** Introduction to SDN, SDN Architecture and Components, SDN Controllers and Applications, OpenFlow Protocol, Benefits and Challenges of SDN, Case Studies on SDN Implementations	06
3.	**Network Function Virtualization (NFV)** Introduction to NFV,NFV Architecture and Components, NFV and SDN Integration, Virtualization Technologies, NFV Use Cases and Applications, Case Studies on NFV Deployments	06
4.	**Data Center Networking** Data Center Network Architectures, Intra-Data Center Networking, Inter-Data Center Networking, Network Virtualization in Data Centers, Cloud Data Centers and Networking, Case Studies on Data Center Networking	07
5.	**Internet of Things (IoT) Networking** Introduction to IoT Networking, IoT Network Architectures, Protocols and Standards for IoT, Security in IoT Networks, IoT Applications and Case Studies, Challenges and Future Directions in IoT Networking	06
6.	**Advanced Topics in Network Architectures** Network Automation and Orchestration, Edge and Fog Computing Architectures, High-Performance Computing Networks, Quantum Networking, Future Trends in Network Architectures	06

Sr. No.	Reference Books
1.	"Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross,Publisher: Pearson
2.	"Software Defined Networks: A Comprehensive Approach" by Paul Goransson, Chuck Black, and Timothy Culver,Publisher: Morgan Kaufmann
3.	"Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti, Publisher: VPT
4.	"Software-Defined Networking (SDN): Anatomy of OpenFlow Volume I" by Doug Marschke, Jeff Doyle, and Pete Moyer,Publisher: Createspace Independent Publishing Platform

5.	"Data Center Networking" by James Long, Publisher: Amazon Digital Services LLC
Sr. No.	**Important web links**
1.	As per requirement

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards				
Course Code	SPM-3.3				
Course Category	Specialization Minor Program Core				
Course title	**Wireless Networking Technologies**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-		03	03
Evaluation Scheme	**ISE:30**			**ESE: 70**	**Total=100**
Pre-requisites (if any)	Computer Networks				
Course Rationale	In today's interconnected world, wireless networking technologies play a pivotal role in facilitating communication across various devices and systems. This course aims to equip students with the fundamental understanding of these technologies to meet the growing demands of the digital era.				
Course Objectives	1. Understand the significance of MANETs and analyze various routing protocols used in MANETs. 2. Introduce WSNs and communication protocols. 3. Explore mobility models and management techniques. 4. Introduce cognitive radio networks and spectrum sensing. 5. Provide an overview of wireless security concepts. 6. Investigate emerging trends in wireless networking.				
Course Outcomes	Students will be able to - 1. Compare and contrast different routing protocols in MANETs. 2. Examine the architecture of sensor networks. 3. Design handoff strategies and protocols to ensure seamless mobility in wireless networks. 4. Propose dynamic spectrum access mechanisms. 5. Identify threats and devise security measures. 6. Analyze the impact of emerging technologies.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	3	3	3	3	3							3	2
CO 2	3	3	3	3	3	3							2	3
CO 3	3	2	3	3	3									
CO 4	3	3	2	3	3	3								
CO 5	3	3	3	3	3	3								
CO 6	3	3	3	3	3	3								

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	**Mobile Ad-Hoc Networks (MANETs)** Introduction to MANETs, Routing Protocols in MANETs, Security Issues in MANETs, Applications of MANETs, Performance Metrics in MANETs, Case Studies on MANET Applications	07
2.	**Wireless Sensor Networks (WSNs)** Introduction to WSNs, Sensor Network Architecture, Communication Protocols for WSNs, Energy Efficiency in WSNs, Security in WSNs, Case Studies on WSN Deployments.	07
3.	**Mobility Management** Mobility Models and Management, Mobile IP and Its Variants, Handoff Strategies and Protocols, Quality of Service (QoS) in Mobile Networks, Location-Based Services, Case Studies on Mobility Management.	06
4.	**Cognitive Radio Networks** Introduction to Cognitive Radio Networks, Spectrum Sensing Techniques, Dynamic Spectrum Access, Cognitive Radio Network Architectures, Cognitive Radio Networks in IoT, Case Studies on Cognitive Radio Networks.	06
5.	**Wireless Security** Overview of Wireless Security, Security Protocols for Wireless Networks, Threats and Vulnerabilities in Wireless Networks, Encryption and Authentication Techniques, Intrusion Detection and Prevention in Wireless Networks, Case Studies on Wireless Security Incidents	05
6.	**Future Trends in Wireless Networks** 5G and Beyond, Edge Computing in Wireless Networks, Block chain for Wireless Networks, AI and Machine Learning in Wireless Networking, Quantum Networking	05

Sr. No.	Reference Books
1.	"Mobile Ad Hoc Networking: Cutting Edge Directions" by Stefano Basagni, Marco Conti, Silvia Giordano, Ivan Stojmenovic (Wiley-IEEE Press)
2.	"Wireless Sensor Networks: Principles and Practice" by Aboelmagd Noureldin, Mohamed A. El-Sharkawy, and Mohamad Y. El-Nashar (CRC Press)
3.	"Wireless Communications and Mobile Computing" by Koushik Sinha (Wiley)
4.	"Cognitive Radio Networks: Architectures, Protocols, and Standards" by Mohamed Ibnkahla (CRC Press)
5.	"Wireless Network Security: A Beginner's Guide" by Tyler Wrightson (McGraw-Hill Education)
Sr. No.	**Important web links**
1.	As per requirement

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards				
Course Code	SPM-3.4				
Course Category	Program Based Internship				
Course title	Internship				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
		-	--	--	03
Evaluation Scheme	**IE:50**		**EE: 50**		**Total=100**
Pre-requisites (if any)	Prerequisites for this course typically include a solid background in Analog & Digital Electronics, Communication Engineering.				
Course Rationale	An internship in Computer Networking offers students the opportunity to apply theoretical knowledge to practical situations, enhancing their skills in network design, implementation, and management. This experience provides valuable industry exposure, preparing students for careers in a rapidly evolving field by bridging the gap between academic concepts and real-world applications.				
Course Objectives	The students will learn 1. To expose students to real working environment and get acquainted with the organization structure, business operations and administrative functions 2. To have hands on experience in the related field to get exposure with the industrial trend 3. To promote cooperation and to develop synergetic collaboration between industry and the university 4. To set the step for future recruitment 5. Get familiarity with professional skills 6. Understand the information required for entrepreneurship				
Course Outcomes	The students will be able to 1. Know the industrial working environment 2. Utilize the technical resources 3. Write technical documents and appear for interview / power point presentations/ technical discussions 4. Develop attitude of a team player and ability of life-long learning 5. Adapt and develop professional skills required for employability 6. Motivation for entrepreneurship				

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1									3	2
CO2	3	2	3	3									2	2
CO3	3	2	3	3	3									
CO4	3	1	3	3										
CO5	3	3		1										
CO6	3	2	3	3	3						3	3		

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Duration
1	Four-week industrial training in a reputed industry from stand point view of network engineering is mandatory. Students should learn and understand the concepts of VLSI system design, industrial organization and management. They should get familiarity with different departments like R & D, production, quality, purchase, sales & marketing and other. Students should submit detail report in the given format to the B.Tech Electronics & Telecommunication Engineering program in which all details of internship must be included. Panel of faculty members appointed by the program coordinator will assess the individual student.	**4 week**
Sr. No.	**Reference Books**	
1	Articles from reputed journals, magazines, websites, real world problems, case studies, Survey reports	
2	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.	
Sr. No.	**Important web links**	
1	As per requirement	

Year, Program, Semester	Specialization Minor IV, 4th Semester onwards						
Course Code	SPM 3.5						
Course Category	Project Based Learning						
Course Title	**Mini Project**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	-	--	-		02	
Evaluation Scheme	**ISE**	**ESE**	**IOE**	**IPE**	**IE**	**EE**	**Total**
	00	00	--	-	50	50	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this mini project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena in green aspects of Industry.						
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.						
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content
Specialization Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular

discipline and develop versatile skill sets pertaining to application of Green Technology.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:

- Rubric-based assessment for the project work and its report.
- Peer evaluation for project.
- Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
- Overall course grading based on a weighted average of individual assessments and participation.

The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Shivaji University
Vidya Nagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

MDM Featured B. Tech (Electronics and Telecommunication Engineering) Honor and Honor with Research, Detailed Curriculum

Shivaji University, Kolhapur
Department of Technology

MDM Featured B. Tech (Electronics and Telecommunication Engineering) with Honors

Teaching and Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) or any other MOOCs Or Self-study mode with University's End Semester Examination (Program Core Courses)	HN- 1	Automotive Electronics	03	-	-	03	03	30:70	00:00
2.		HN- 2	Real Time Operating System	03	-	-	03	03	30:70	00:00
3.		HN- 3	Computer Vision	03	-	-	03	03	30:70	00:00
4.		HN- 4	Cyber security and Privacy	03	-	-	03	03	30:70	00:00
5.		HN- 5	Industry 4.0 and Industrial IoT	03	-	-	03	03	30:70	00:00
6.	Ability Enhancement Course	HN-AEC1	Advanced Laboratory Practice	-	-	04	04	02	-	50:50
				-	-	-	-	17	500	100
			Total Hours	**15**	**-**	**04**	**19**	**-**	**-**	**-**

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">B. Tech Electronics and Telecommunication Engineering (Honors/Honors with Research)</td></tr>
<tr><td>Course Code</td><td colspan="5">HN-1</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Automotive Electronics</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Prerequisites for this course typically include a strong foundation in basic electronics, digital and analog circuits, control systems, signal processing, embedded systems, and familiarity with automotive systems and safety standards.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course aims to equip students with the theoretical knowledge and practical skills necessary to design, analyze, and troubleshoot electronic systems used in modern vehicles, addressing the increasing integration of electronics into automotive applications. By exploring topics such as engine management systems, safety features, communication networks, and emerging technologies, students gain a comprehensive understanding of the complexities and advancements driving innovation in automotive electronics.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Provide the fundamentals of Automotive vehicle system.
2. Explain Automotive Sensory System.
3. Understand the Automotive Actuators.
4. Demonstrate the knowledge of Intra processor communication protocol.
5. Demonstrate the knowledge of Electronic Communication Protocols.
6. Make students able to compare Automotive Grade Microcontrollers.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Students will be able to:
1. Comprehend the roles and implementations of various systems used in automotive.
2. Understand the automotive sensory systems.
3. Discuss the various actuators for automotive systems.
4. Understand need for protocol & intra processor communication protocol.
5. Understand working various automotive protocols and compare them.
6. Compare Automotive Grade Microcontrollers</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	1	1								
CO 2	3	2	3	3								
CO 3	3	2	3	3	3							
CO 4	3	1	3	3								
CO 5	3	3		1								
CO 6	3	2	3	3	3							3
PSO 1	3	3	3	3	2							
PSO 2	2	3	1	3	2							

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	**Automotive Systems Overview** Automotive Vehicle Technology, Overview of Vehicle Categories, Various Vehicle Sub Systems like Chassis, Body, Driveline, Engine, Fuel, Emission, Brakes, Suspension, Doors, Safety & Security, Comfort & Multimedia, Communication & Lighting, Future Trends in Automotive Embedded Systems: Drive by Wire, Autopilot, Robotics.	06
2.	**Automotive Sensory System Concept to Market** Understanding Automotive Product Design Cycle, Building Blocks of Automotive Electronic Product -Automotive Sensors and Transducers: Types, Force, Humidity, Carbon Dioxide (CO2), Carbon Monoxide (CO), Oxygen (O2) Sensor, LAMBDA Sensor, Proximity Distance Sensors, Speed, Engine Knock Sensor, Flow Sensor, New developments in sensor technology.	05
3.	**Automotive Actuators** Introduction, Function & Operating principle, Construction & working of solenoid actuators, Relays, Motorized actuators, Thermal Actuators, Electro-hydraulic & ElectroElectronics and Telecommunication Valve actuators, Application & New Developments in the Actuators Technology.	05
4.	**Automotive Protocols I** The need for Protocol, Intra processor Communication Protocols: UART, I2C & I2S, SPI, RS485 MODBUS & USB.	06

5.	**Automotive Protocols II** LIN, CAN, Overview of - KWP2000, J1850 & J1939 Flex Ray	**08**
6.	**Automotive Grade Microcontrollers** Overview of Automotive Grade Microcontrollers, Microcontrollers with Built in CAN Interface ATMega164P, AT32UC3C2512C, Safety Critical Microcontrollers like Hercules TMS470M ARM Cortex-M3 Series, Case study- cruise control of car, Artificial Intelligence and engine management.	**06**

Sr. No.	**Text/Reference Books**
1.	Understanding Automotive Electronics by William B. Ribbens
2.	Automobile Electrical and Electronic Systems by Tom Denton
3.	Automobile Engineering Vol 1 &Vol 2 by Kripal Singh
4.	Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive.
5.	Automobile Mechanics by W.H. Crouse, Tata McGraw Hill.
Sr. No.	**Important web links**
1.	https://archive.nptel.ac.in/courses/107/106/107106088/
2.	https://www.udemy.com/course/basics-of-automotive-electronics/?couponCode=LETSLEARNNOWPP
3.	https://www.udemy.com/course/automotive-electrics-and-automotive-electronics/?couponCode=LETSLEARNNOWPP

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">B. Tech Electronics and Telecommunication Engineering (Honors/Honors with Research)</td></tr>
<tr><td>Course Code</td><td colspan="5">HN-2</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Real Time Operating System</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td>05</td><td>04</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30
IOE: 25</td><td colspan="2">ESE:70
EOE: 25</td><td>Total: 150</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Prerequisites:
Basic understanding of Real Time Embedded System and programming
Separate purchase of hardware and/or software tools, in order to replicate the course labs</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course offers participants a foundational understanding of Embedded System, Operating System and real time operating system. This knowledge serves as a stepping stone for further studies and career opportunities in Electronics as well as in Computer Sci. and Engineering, automation, and related fields.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">Knowledge and understanding of
Basic concepts of Operating System and RTOS, task and threads
Task scheduling and memory allocation
File system and data management
Parallel programming principles
Example RTOSs and applications.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After completion of this course the student will be able to:
Describe theoretical and practical concepts, and functioning of operating system.
Distinguish a real-time system from other systems
Discuss the specifications, design requirements and kernel techniques in development of RTOS.
Evaluate real time operating systems based on real time applications with different models.
Implement the real-time operating system principles.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2				2							
CO 2	3	2	2		2							
CO 3	3									2		
CO 4		2	2		3							
CO 5		2	2									

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	**BASIC REAL TIME CONCEPTS** Real time definition, Examples of real time systems, Real -Time Kernels, foreground /background systems, Real time operation, Full-Featured real- Time operating systems, Process State and Control block, Process Scheduling Queues and Schedulers, Process Creation and Termination, Inter Process Communication IPC, Client - Server System Communication.	**08**
2.	**RTOS PROGRAMMING FUNDAMENTALS:** Task control block model, task management, Tasks and Task states – Semaphores – Shared data – Message queues, Mail boxes and pipes –Memory management – Interrupt routines – Encapsulating semaphore and queues.	**06**
3.	**RTOS FUNDAMENTALS:** Task management – Dual role of time – Inter task communication - Process input/output, Threading, Synchronization Concepts, The Critical Section Problem, Hardware Synchronization, Mutex Locks, Semaphores,	06
4.	**REAL TIME SCHEDULING:** Concepts and Criteria, Algorithms for Scheduling, Thread and Multiprocessor Scheduling, Real Time scheduling. Schedulability problem: classification, schedulability test, worst case execution time (WCET) – static scheduling: - dynamic scheduling: dependent tasks, independent tasks. Deadlocks- Characterization, Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock	06
5.	**REAL TIME OPERATING SYSTEMS:** VX works - uCOS – POSIX standards - RT Linux – device drivers - Real time library of Keil IDE -RTOS Porting to a Target.	**08**

6.	**RTOS APPLICATION DOMAINS:** Case studies: Free-RTOS architecture - Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems, RTOS for Digital Signal Processing - Examples and Discussion	06

Sr. No.	Reference Books
1.	David Simon, "An Embedded software premier", Pearson education, 2007.
2.	Hermann Kopetz, "Real–Time systems – Design Principles for distributed Embedded Applications", Second Edition, Springer 2011.
3.	Micro C OS II reference manual.
4.	VX works Programmers manual.
5.	Keil Real Time library documentation
6.	Doug Abbott, "Linux for embedded and real time applications", Elsevier Science, 2003.
7.	"Getting started with RT-Linux", FSM Labs., Inc.,
8.	ARM Educational Web Link {https://www.arm.com/resources/education/education-kits

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">B. Tech Electronics and Telecommunication Engineering (Honors/Honors with Research)</td></tr>
<tr><td>Course Code</td><td colspan="5">HN3</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Computer Vision</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Include a strong foundation in mathematics (linear algebra, calculus, probability theory), programming skills (Python preferred), and familiarity with basic concepts in image processing and machine learning.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Computer vision involves exploring theories and algorithms that enable computers to interpret visual data, leading to applications in fields such as robotics, medical imaging, autonomous vehicles, and augmented reality.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. To review image processing techniques for computer vision
2. To understand shape and region analysis.
3. To understand Hough Transform and its applications to detect lines, circles, ellipses.
4. To understand three-dimensional image analysis techniques.
5. To understand motion analysis.
6. To study some applications of computer vision algorithms.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Implement fundamental image processing techniques required for computer vision.
2. Perform shape analysis.
3. Apply Hough Transform for line, circle, and ellipse detections.
4. Apply 3D vision techniques.
5. Implement motion related techniques.
6. Develop applications using computer vision techniques.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	1	1								
CO 2	3	2	3	3								
CO 3	3	2	3	3	3							
CO 4	3	1	3	3								
CO 5	3	3		1								
CO 6	3	2	3	3	3							3
PSO 1	3	3	3	3	2							
PSO 2	2	3	1	3	2							

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**UNIT I IMAGE PROCESSING FOUNDATIONS** Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.	05
2	**UNIT II SHAPES AND REGIONS** Binary shape analysis – connectedness – object labelling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroid profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.	06

3	**UNIT III HOUGH TRANSFORM** Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate centre location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.	**07**
4	**UNIT IV 3D VISION** Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction –	**06**
5	**UNIT V 3D MOTION** Introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.	**06**
6	**UNIT VI APPLICATIONS** Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.	**07**

Sr. No.	**Reference Books**
1	"Computer Vision: Algorithms and Applications" by Richard Szeliski
2	Computer Vision: A Modern Approach" by David Forsyth and Jean Ponce
3	"Introduction to Computer Vision: A Practical Approach with Python" by Jan Erik Solemn
4	R. Szeliski, ―Computer Vision: Algorithms and Applications
5	E. R. Davies, ―Computer & Machine Vision‖, Fourth Edition, Academic Press

Sr. No.	**Important web links**
1	Coursera - Introduction to Computer Vision

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">B. Tech Electronics and Telecommunication Engineering (Honors/Honors with Research)</td></tr>
<tr><td>Course Code</td><td colspan="5">HN-4</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Cyber Security & Privacy</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Analog Electronics, Digital Electronics</td></tr>
<tr><td>Course Rationale</td><td colspan="5">In an increasingly digitized world, cybersecurity and privacy have emerged as critical concerns for individuals, organizations, and governments. This course seeks to provide students with a comprehensive understanding of the principles, techniques, and best practices in cybersecurity and privacy, enabling them to safeguard information assets, protect privacy rights, and mitigate cyber threats effectively.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Understand the foundational concepts and terminologies of cyber security.
2. Analyse cyber security vulnerabilities and explore safeguards including authentication, cryptography, and intrusion detection systems.
3. Identify and classify common cyber-attacks such as malware, phishing, and SQL injection.
4. Understand the principles of intrusion detection and prevention techniques, including network-based and host-based approaches.
5. Explore various types of firewalls and security protocols at different network layers.
6. Examine cyber security regulations, international law roles, and legal frameworks such as the IT Act 2000 and Cyber Forensics.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Students will be able to define cyber security, identify various cyber threats, and recognize the importance of comprehensive cyber security policies.
2. Students will be able to assess different cyber security vulnerabilities, implement basic security measures, and comprehend the role of various safeguards in mitigating cyber threats.
3. Students will be able to recognize different types of cyber-attacks, understand their mechanisms, and evaluate strategies to defend against them.
4. Students will be able to explain the functioning of intrusion detection systems, implement intrusion prevention techniques, and assess their effectiveness in safeguarding against intrusions.
5. Students will be able to differentiate between types of firewalls, configure firewall rules, and demonstrate knowledge of security protocols such as SSL/TLS and IPSec.</td></tr>
</table>

	6. Students will be able to interpret cyber security regulations, understand the legal implications of cyber-crimes, and demonstrate knowledge of cyber forensic investigation techniques.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO 1	3	3		2									3	2
CO 2		3	2	2									2	3
CO 3	3		2											
CO 4			2		2									
CO 5	2	3	2	3										
CO 6	3	3	3	2										

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Introduction to Cyber Security**: Overview of Cyber Security, Cyber Threats, Cyber Warfare, Cyber Crime, Cyber terrorism- Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Cyber security prevention tips	05
2	**Vulnerabilities:** Cyber Security Vulnerabilities and Cyber Security Safeguards , Authentication, Biometrics, Cryptography, Ethical Hacking, Firewalls, Intrusion Detection Systems, Threat Management, Basic security for HTTP Applications and Services	06
3	**Cyber Attacks:** Malware, Phishing, Man-in-the-middle, SQL injection, Zero-Day exploit, Ransomware, Mobile Threats, Brute Force Attack, DNS Spoofing	06
4	**Intrusion Detection System** Intrusion Detection and Prevention: Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems	07

5	**Firewalls:** Overview of Firewalls- Types of Firewalls, User Management, VPN Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.	**06**
6	**Cyber Laws:** Cyber Security Regulations, Roles of International Law, IT ACT 2000, National Cyber Security Policy 2013, Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding	**06**
Sr. No.	**Reference Books**	
1	S.B.Gaikwad,K.G.Kharade,Rashmi Agrawal, R.K.Kamat (2022), Cybersecurity: The Essential Guide by Pacific Books International, ISBN 978-93-92469-11-4	
2	Cyber law: The Law of the Internet and Information Technology by Brian Craig.	
3	Cyber Security by Nina Godbole and Sunit Belapure	
4	Cyber Security and Cyber Laws by Nilakshi Jain and Ramesh Menon	
Sr. No.	**Important web links**	
1	https://onlinecourses.nptel.ac.in/noc23_cs127/preview	
2	https://cybercrime.gov.in/	
3	https://www.cert-in.org.in/	
4.	https://www.dsci.in/	
5.	https://www.meity.gov.in/cyber-security-division	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">B. Tech Electronics and Telecommunication Engineering
(Honors/Honors with Research)</td></tr>
<tr><td>Course Code</td><td colspan="6">HN-5</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Industry 4.0 and Industrial IoT</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td colspan="2">Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="6">Basic knowledge of computer and internet</td></tr>
<tr><td>Course Rationale</td><td colspan="6">The Industry 4.0 and Industrial IoT course is designed to equip students with a comprehensive understanding of the integration of advanced technologies in manufacturing and industrial processes. As Industry 4.0 and Industrial IoT play pivotal roles in transforming traditional industries, this course aims to provide students with the knowledge and skills needed to navigate the complex landscape of smart manufacturing. By exploring concepts such as cyber-physical systems, data analytics, and connectivity, students will be prepared to contribute to the optimization and innovation of industrial processes.</td></tr>
<tr><td>Course Objectives</td><td colspan="6">1. Introduce students to the principles and components of Industry 4.0.
2. Investigate the integration of physical processes with digital technologies in cyber-physical systems.
3. Familiarize students with the technologies underpinning Industrial IoT.
4. Teach students how to collect, process, and analyze data generated by industrial systems.
5. Examine the role of IoT in creating interconnected systems in the manufacturing environment.
6. Explore the collaboration between humans and machines in smart manufacturing</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">1. Explain the principles and components of Industry 4.0.
2. Analyze and implement Industrial IoT technologies in manufacturing.
3. Design and implement Cyber-Physical Systems (CPS) for industrial applications.
4. Knowledge of theory and practice related to Industrial IoT Systems.
5. Ability to identify, formulate and solve engineering problems by using Industrial IoT.
6. Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3		2	2									3	3
CO 2	3			2									3	
CO 3	3		2											2
CO 4			3											2
CO 5			3		3									
CO 6					3								3	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Introduction to Industrial IoT (IIoT) Systems:** The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.	06
2	**Cyber Physical Systems:** Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis	06
3	**Implementation systems for IIoT:** Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.	06
4	**IIoT Data Monitoring & Control** IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.	06
5	**Industrial IoT- Applications:** Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.	06
6	**Case Studies of IIoT Systems:** IIoT application development with Embedded PC based development boards, Development of mini Project on new version of Operating systems and Edge	06

	development board. That project should also address to the current societal needs.	

Sr. No.	Reference Books
1	"Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress)
2	"Industrial Internet of Things: Cybermanufacturing Systems"by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer)
3	Research papers.
Sr. No.	**Important web links**
1	https://onlinecourses.nptel.ac.in/noc20_cs69/preview

<table>
<tr><td>Year,Program, Semester</td><td colspan="7">B. Tech Electronics and Telecommunication Engineering (Honors/Honors with Research)</td></tr>
<tr><td>Course Code</td><td colspan="7">HNR-AEC1</td></tr>
<tr><td>Course Category</td><td colspan="7">Ability Enhancement Course</td></tr>
<tr><td>Course title</td><td colspan="7">Advanced Laboratory Practice</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>04</td><td colspan="2">04</td><td colspan="2">02</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>-</td><td>50</td><td>50</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Fundamental courses of Electronics & Telecommunication Engineering</td></tr>
<tr><td>Course Rationale</td><td colspan="7">This course is designed to provide students with advanced laboratory skills and techniques relevant to Electronics & Telecommunication engineering. The focus will be on hands-on experiments and the application of theoretical concepts to practical situations.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at
1. Explain theoretical knowledge to design and conduct advanced experiments in Electronics & Telecommunication engineering.
2. Enhance skills in system design.
3. Develop proficiency in utilizing advanced laboratory equipment and techniques.
4. Promote teamwork, communication, and presentation skills through collaborative laboratory projects.
5. Understand safety protocols and ethical considerations in a laboratory setting.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to
1. Design and execute experiments independently, demonstrating a comprehensive understanding of the underlying principles.
2. Analyze and interpret experimental data using suitable methods and present results effectively.
3. Demonstrate proficiency in using advanced laboratory equipment and techniques.
4. Work collaboratively in a team setting, fostering effective communication and problem-solving skills.
5. Tackle on to safety protocols and ethical standards in a laboratory environment.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	2	1	-	-	-	3	-	-	2
CO 2	1	3	2	2	-	-	-	-	2	3	-	2
CO 3	3	1	3	2	-	-	-	-	3	-	-	2
CO 4	-	2	-	3	-	-	-	3	3	2	3	2
CO 5	-	-	-	-	3	-	3	3	3	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

General Instructions: Any 8 experiments to be performed based on the curriculum given for Honor. Students have to submit the journal of experiments to department.	
Text Books/ Reference Books	
1.	Understanding Automotive Electronics by William B. Ribbens
2.	Doug Abbott, "Linux for embedded and real time applications", Elsevier Science, 2003.
3.	"Introduction to Computer Vision: A Practical Approach with Python" by Jan Erik Solemn
4.	Cyber Security by Nina Godbole and Sunit Belapure
5.	Industry 4.0: The Industrial Internet of Things, by Alasdair Gilchrist (Apress)
Useful Web links	
1.	https://archive.nptel.ac.in/courses/107/106/107106088/
2	ARM Educational Web Link {https://www.arm.com/resources/education/education-kits
3	Coursera - Introduction to Computer Vision
4	https://onlinecourses.nptel.ac.in/noc23_cs127/preview
5	https://onlinecourses.nptel.ac.in/noc20_cs69/preview

Shivaji University, Kolhapur
Department of Technology

MDM Featured B. Tech (Electronics and Telecommunication Engineering) Honors with Research

Teaching and Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) or any other MOOCs Or Self-study mode with University's End Semester Examination (Program Core Courses)	HNR- 1	Automotive Electronics	03	-	-	03	03	30:70	00:00
2.		HNR- 2	Real Time Operating System	03	-	-	03	03	30:70	00:00
3.		HNR - 3	Computer Vision	03	-	-	03	03	30:70	00:00
4.		HNR - 4	Cyber security and Privacy	03	-	-	03	03	30:70	00:00
5.		HNR - 5	Industry 4.0 and Industrial IoT	03	-	-	03	03	30:70	00:00
6.	Ability Enhancement Course	HNR-AEC1	Advanced Laboratory Practice	-	-	04	04	02	-	50:50
7.	Project Based Learning	HNR –PBL	*Additional Research Project	-	-	06	06	03	-	50:50
				-	-	-	-	**20**	**500**	**200**
			Total Hours	**15**	-	**10**	**25**	-	-	-

Note: For Honors with Research, the courses and the credits as that for Honors will be the same. In addition, there will be 3 credits against an additional research project completion with success in publishing at least one research paper in a peer reviewed journal.

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">B. Tech Electronics and Telecommunication Engineering (Honors with Research)</td></tr>
<tr><td>Course Code</td><td colspan="7">HNR-PBL</td></tr>
<tr><td>Course Category</td><td colspan="7">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="7">Additional Research Project</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>06</td><td colspan="2">06</td><td colspan="2">03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>-</td><td>50</td><td>50</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">All the courses underlying MDM Featured B.Tech (Electronics and Telecommunication Engineering) Major.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The Additional Research Projects course allows B.Tech Electronics and Telecommunication Engineering Major students to pursue advanced research, enhancing their skills and contributing to the field. This course aims to foster critical thinking, problem-solving skills, and research acumen among students while allowing them to explore topics of personal interest and relevance to the discipline. Completion of this course and the attainment of the B.Tech Honors with research Degree make students eligible for Ph.D. studies, facilitating their academic and research progression in Electronics and Telecommunication engineering or related fields.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The Course Teacher will
1. To facilitate exploration of focused research areas in Electronics and Telecommunication engineering.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to
1. Formulate research questions and design methodologies.
2. Analyze and interpret data effectively.
3. Synthesize literature to contextualize research.
4. Present findings effectively through oral and written communication.
5. Demonstrate critical thinking and problem-solving in research.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12

CO 1	-	-	-	3	-	-	-	-	2	-	-	2
CO 2	3	-	-	3	2	-	-	-	-	-	-	-
CO 3	3	-	-	-	-	2	-	-	-	-	-	2
CO 4	-	-	-	-	-	-	-	-	-	3	2	-
CO 5	-	3	2	-	-	-	-	2	2	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content
I	**Topic Selection and Proposal Development:** • Identifying research gaps and formulating research questions. • Writing a research proposal outlining objectives, methodology, and expected outcomes. • Conducting rigorous ' research topic relevant literature survey'
II	**Research Methodologies:** • Introduction to research design and planning. • Data collection techniques and tools. • Statistical analysis methods.
III	**Conducting Research:** • Implementing the proposed methodology. • Data collection, analysis, and interpretation. • Troubleshooting research challenges.
IV	**Presentation and Communication:** • Preparing and delivering oral presentations. • Writing research reports following standard scientific formats. • Communicating research findings effectively to diverse audiences.

Course Assessment Method

Assessment in this course will be based on the following criteria:

1. Research Proposal (20%): Evaluation of the clarity, feasibility, and originality of the research proposal.
2. Research Progress (30%): Assessment of the student's progress in conducting the research project, including data collection, analysis, and interpretation.
3. Final Research Report (30%): Evaluation of the quality of the written research report, including organization, clarity, depth of analysis, and adherence to scientific standards.
4. Oral Presentation (20%): Assessment of the student's ability to effectively communicate research findings through a formal presentation.

Additionally, continuous engagement, participation in research discussions, and adherence to deadlines will be considered in the overall assessment of the course.

Text Books/ Reference Books

1.	Towler, G., & Sinnott, R. K. (2012). Electronics and Telecommunication Engineering Design: Principles, Practice, and Economics of Plant and Process Design.
2.	Crowl, D. A., & Louvar, J. F. (2011). Electronics and Telecommunication Process Safety: Fundamentals with Applications.
3.	McCabe, W. L., Smith, J. C., & Harriott, P. (2005). Unit Operations of Electronics and Telecommunication Engineering.
4.	Geankoplis, C. J. (2003). Transport Processes and Separation Process Principles.
5.	Solen, K. A., & Harb, J. N. (2018). Introduction to Electronics and Telecommunication Engineering: Tools for Today and Tomorrow.
6.	Smith, J. M., Van Ness, H. C., & Abbott, M. M. (2005). Electronics and Telecommunication Engineering Kinetics.
7.	Foust, A. S., Wenzel, L. A., Clump, C. W., & Maus, L. (1980). Principles of Unit Operations.
8.	Fogler, H. S. (2016). Essentials of Electronics and Telecommunication Reaction Engineering. 4th Edtn.
9.	Smith, J. M., Van Ness, H. C., Abbott, M. M., & Swihart, M. (2005). Electronics and Telecommunication Engineering Thermodynamics.
10.	Coughanowr, D. R., & LeBlanc, S. E. (2009). Process Systems Analysis and Control.

Shivaji University, Kolhapur

Department of Technology

B. Tech (Electronics and Telecommunication Engineering), Exit after Second Year (Diploma in Electronics and Telecommunication Engineering)

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) Or Any other MOOCs Or Face to face mode Or Self-Study Mode (Program Core Courses)	DC- ETC 1	Consumer Electronics	02	-	-	02	02	30:70	00:00
2.		DC- ETC 2	Microcontrollers	02	-	-	02	02	30:70	00:00
3.		DC- ETC 3	Introduction to software tools in Electronics Industry	02	-	-	02	02	30:70	00:00
4.	Program Based Internship	DC-PBI	In plant Training	One Month				04	00:00	50:50
				-	-	-	-	**10***	**300****	**100**
			Total Hours	**06**	-	-	**06**	-	-	-

Note: The Workload against the Diploma Course will be finalised at the Program Level considering the strength of the students seeking for the Diploma.

*Obtaining these credits will be in addition to 85 regular credits up to SY B. Tech. Also in such cases, acquiring certificate after First Year is mandatory.

** There is an option for End Semester Examination either on respective MOOC platform if any or through the University System.

Note: Program Specific Industry Internship to be completed by such students before commencement of TY B. Tech.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Exit after Second Year of B. Tech (Electronics & Telecommunication Engineering), Diploma Claim</td></tr>
<tr><td>Course Code</td><td colspan="5">DC-ETC 1</td></tr>
<tr><td>Course Category</td><td colspan="5">Course for Diploma in Electronics & Telecommunication Engineering</td></tr>
<tr><td>Course title</td><td colspan="5">Consumer Electronics</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td>02</td><td>02</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3">ISE:30</td><td>ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Prerequisites: Basic understanding of Electronics components and its principles of working, communication systems etc.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course offers participants a brief knowledge of working of Audio technology, Broadcasting receivers, Television technology, media players and their troubleshooting, multimedia and its applications, different security and safety systems.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Understand principles and working of microphones, speakers, audio amplifier, PA system
2. Explain working of AM and FM receiver, troubleshooting of receivers
3. Explain the principle of television, TV fundamentals, Display technologies
4. Explain the working of , audio and video CD players, DVD players
5. Introduce the multimedia , audio and video formats related to multimedia, its applications
6. Explain the different security and safety systems.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Understand principles and working of microphones, speakers, audio amplifier, PA system and its troubleshooting
2. Understand working of AM and FM receiver, troubleshooting of receivers
3. Understand the principle of television, TV fundamentals, Display technologies and fault findings
4. Understand the working of audio and video CD players, DVD players and its fault findings.
5. Understand the multimedia , audio and video formats related to multimedia, its applications
6. Understand the different security and safety systems such as CCTV, Burglar alarm etc.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1			3	2	2							
CO 2		3	2	2								
CO 3		2	3	2	2							
CO 4			2		2	2						
CO5	3				3							
CO6	3	2	3		3		2					
PSP1	3	3	3									
PSO2	3	3	3									

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	• **Audio Technology** • Principle & working of microphone • Types of microphone and their application • Principle & working of speakers • types of speakers: PMMC • Frequency response of speaker • Audio amplifier • Application of audio amplifiers: PA system	04
2.	• **Broad Casting Receiver** • AM Receiver: Explain- - TRF • super heterodyne • Double heterodyne • FM Receiver: Ratio Detector • Foster seeley phase discriminator • FM Channels, Qualities of receivers	04
3.	• **TV Technology** • Principles of Television: TV standards Scanning Video Bandwidth Modulation techniques Channel allocation, Composite Video signal, TV Camera – Principle & working of Vidicon TV Camera. TV Receiver – block diagram and working of B&W receiver and PAL Receiver, Display Technologies: - CRT Monitor, LCD Monitor PLASMA monitor	0 4
4.	• **Media Players** • Block Diagram of Players: - Audio CD Players • Video CD Players • DVD Players • Introduction to Blue Ray disc player, HD DVD	04

5.	• **Multimedia** • Introduction to multimedia, • Different audio and video formats related to multimedia MPEG1, MPEG2, MPEG3, MPEG4, • Multimedia editing tools- Movie Maker, Nero wave Editor. • Application of multimedia in education, entertainment, advertisement, research. • PROJECTORS : - DLP Projector • LCD Projector LED Projector	**04**
6.	• **Security & Safety System:** • Burglar's alarm • Video door phone • CCTV • Electronic combination locks	**04**
Sr. No.	**Reference Books**	
1.	Bali S.P. Consumer Electronics. Pearson Education India, Delhi (2007)	
2.	Gupta R.G. Audio Video systems principles, maintenance and troubleshooting ,Mc graw Hill, New Delhi, India (2010)	
3.	Bali Rajeev, Bali S.P.Audio Video Systems: Principle practices and troubleshooting, Khanna Book Publishing Co.(P) Ltd., Delhi (2014)	
4.	Gulati R.R.Modern Television Practice: Transmission, Reception and Applications, New Age International, New Delhi (2015)	
Sr. No.	**Important web links**	
1.	https://www.youtube.com/watch?v=zLHwLLCBtEI&list=PLy3MD_-7Q9uzdwLBU48EPhSe8tw9oNylw	
2.	https://www.youtube.com/watch?v=mBbDipX2P48	
3.	https://www.youtube.com/watch?v=Hx4TVr4J7H0	

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Exit after Second Year of B. Tech (Electronics & Telecommunication Engineering), Diploma Claim</td></tr>
<tr><td>Course Code</td><td colspan="5">DC-ETC 2</td></tr>
<tr><td>Course Category</td><td colspan="5">Course for Diploma in Electronics & Telecommunication Engineering</td></tr>
<tr><td>Course title</td><td colspan="5">Microcontrollers</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3">ISE:30</td><td>ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Prerequisites for this course typically include a solid background in analog and digital circuit design, microcontrollers.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course provides a comprehensive introduction to the core principles and concepts in electric vehicle design.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">Students will be able to:
1. Discuss the fundamentals of microprocessors and microcontrollers
2. Explain the architecture of MCS 51 family
3. Illustrate the assembly language instructions and write assembly language programs
4. Illustrate C language programming for 8051 microcontroller
5. Describe interfacing and device programming
6. Discuss the architecture and programming for PIC microcontrollers</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Students will be able to:

1. Compare between microprocessors and microcontrollers.
2. Describe the architectural features of 8051 microcontroller.
3. Develop programs in assembly for 8051 microcontroller
4. Develop programs in C language for 8051 microcontroller
5. Interface the devices to microcontroller and write program to control the devices
6. Describe architecture of PIC microcontrollers and develop programs</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	3	3	1					2	2
CO 2	3	3	3	3	3	1					2	2

CO 3	3	3	3	3	3	1					2	2
CO 4	3	3	3	3	3	1					2	2
CO 5	3	3	3	3	3	1					2	2
CO 6	3	3	3	3	3	1					2	2
PSO1	3	3	3	3	3						2	2
PSO2	3	3	3	3	3						2	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1	**Unit I- Fundamentals of Microcontrollers** Evolution of microprocessors & microcontrollers, microprocessors v/s microcontrollers 8/16/32 bit processors & controllers, CISC v/s RISC architectures, registers, memory & types of memory, bus, interrupts	06
2	**Unit II- MCS-51 Microcontroller family** Introduction to MCS-51 architecture, 8051 microcontroller hardware, Input /output pins, external memory, register files, counters and timers, interrupts, serial communication, development tools IDE	06
3	**Unit III- Instruction set and assembly language programming** Addressing modes, instruction set of 8051 microcontroller, assembly language programs	06
4	**Unit IV- Embedded C programming** Comparison of assembly and embedded c language programming, data types, variables, operators, storage classes, arrays, strings, C language programming for 8051 microcontroller	06
5	**Unit V- MCS-51 Microcontroller interfacing and programming** Interfacing of LEDs, DC motors, stepper motors, buzzers, switches, matrix keyboards, seven segment displays, LCD displays, ADC, DAC, relays, thumbwheel , interfacing I^2C,SPI bus devices,RS232	06
6	**Unit VI- Introduction to PIC microcontroller family** Microchip PIC 16F8XX microcontroller family , CPU architecture, register file structure, I/O ports and TRIS registers, interrupts, timers, oscillator configurations, reset alternatives, WDT, sleep mode , on chip resources, interrupt structure, instruction set, assembly and C language programming	06

Sr. No.	Reference Books
1	Kenneth Ayala, "The 8051 Microcontroller Architecture, programming and Applications" Penram Intrnational
2	Muhammad Ali Mazidi, "The 8051 Microcontroller and Embedded systems" Pearson Education Asia LPE
3	Ajay Deshmukh, " Microcontrollers: Theory and applications ", Tata McGraw hill edition
4	Microchip PIC 16F877 family Microcontrollers Data sheet
Sr. No.	**Important web links**
1	Microchip PIC 16F8XX family Microcontrollers Data sheet
2	https://onlinecourses.nptel.ac.in/noc22_ee12/preview

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Exit after Second Year of B. Tech (Electronics & Telecommunication Engineering), Diploma Claim</td></tr>
<tr><td>Course Code</td><td colspan="5">DC-ETC 3</td></tr>
<tr><td>Course Category</td><td colspan="5">Course for Diploma in Electronics & Telecommunication Engineering</td></tr>
<tr><td>Course title</td><td colspan="5">Introduction to software tools in Electronics Industry</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3">ISE:30</td><td>ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Prerequisites for this course typically include a solid background in analog and digital circuit design, microcontrollers.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course provides a comprehensive introduction to the core principles and concepts in electric vehicle design.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">Students will be able to:
1. Learn PCB design layout and schematic
2. Learn analysis and simulation of analog circuits
3. Learn simulation of digital circuits
4. Learn system modelling using MATLAB
5. Learn Microcontroller programming
6. Learn HDL programming</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Students will be able to:

1. Design PCB using suitable CAD tool
2. Simulate analog circuits using suitable CAD tool
3. Simulate digital circuits using suitable CAD tool
4. Model systems using MATLAB
5. Simulate microcontroller based systems
6. Simulate digital chips using suitable tools</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	3	1					2	2
CO 2	3	3	3	3	3	1					2	2
CO 3	3	3	3	3	3	1					2	2
CO 4	3	3	3	3	3	1					2	2
CO 5	3	3	3	3	3	1					2	2
CO 6	3	3	3	3	3	1					2	2
PSO1	3	3	3	3	3						2	2
PSO2	3	3	3	3	3						2	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	**Course Content**	**Hours**
1	PCB design software Any one suitable software for printed circuit design and development like KiCad, Proteus, Eagle, Esim or other suitable open source software. PCB tracing and trouble shooting	**06**
2	Analog circuits software Any one suitable software for analog circuit design and simulation e.g. PSPICE , MultiSim, Proteus or other suitable open source software.	**06**
3	Digital Circuits software Any one suitable software for digital circuit design and simulation e.g. digital circuit design, KiCAD or other suitable open source software.	**06**
4	MATLAB for modelling and simulation Modelling and simulation using MATLAB , SIMULINK and other suitable tool boxes.	**06**
5	Microcontroller IDE Use of IDE like KeiluVision and Proteus for 8051 microcontroller or MPLAB and Proteus for PIC 16F8XX series	**06**
6	VLSI Design software Any one suitable software tool for digital chip design like Cadence, Microwind, ISE , Vivado	**06**
Sr. No.	**Reference Books**	
1	Walter Bosshart, " Printed Circuit Boards: Design and Technology", McGraw Hill	
2	David A. Bell "Electronics, Devices and Circuits" Oxford University Press	

3	R. P. Jain, “Modern Digital Electronics”, McGraw Hill
4	M.A. Mazidi, “The 8051 Microcontroller and Embedded systems: Using assembly and C”, Pearson
5	Joseph Cavanaga “Verilog HDL Design examples” CRC press
Sr. No.	**Important web links**
1	https://onlinecourses.swayam2.ac.in/aic20_sp59/preview
2	https://onlinecourses.nptel.ac.in/noc20_ee45/preview
3	https://onlinecourses.nptel.ac.in/noc20_ee32/preview
4	https://onlinecourses.nptel.ac.in/noc20_ge05/preview
5	https://onlinecourses.nptel.ac.in/noc20_ee42/preview
6	https://onlinecourses.nptel.ac.in/noc20_cs18/preview

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">Exit after Second Year of B. Tech (Electronics and Telecommunication Engineering), Diploma Claim</td></tr>
<tr><td>Course Code</td><td colspan="7">DC-PBI</td></tr>
<tr><td>Course Category</td><td colspan="7">Course for Diploma in Electronics and Telecommunication Engineering</td></tr>
<tr><td>Course title</td><td colspan="7">In Plant Training</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td colspan="4">One Month</td><td colspan="2">04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>50</td><td>-</td><td>50</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Completion of All the course of FY B. Tech Electronics and Telecommunication Engineering Major, also the completion of all the courses to claim Certificate in Electronics and Telecommunication Engineering.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The purpose of the In Plant Training course is to provide students with practical exposure to the Electronics and Telecommunication engineering industry. This hands-on experience allows students to apply theoretical knowledge gained in the classroom to real-world scenarios. By engaging in industrial training, students develop essential skills, gain industry insights, and enhance their employability in the Electronics and Telecommunication engineering field.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The training will ensure students
1. To gain practical exposure to industrial processes in Electronics and Telecommunication engineering.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of the In-Plant Training course, students will be able to
1. Understand industrial processes in Electronics and Telecommunication engineering.
2. Apply theoretical knowledge to practical situations.
3. Utilize tools and techniques effectively in experiments.
4. Identify and mitigate workplace safety hazards.
5. Collaborate effectively in multidisciplinary teams.
6. Communicate findings professionally.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-

CO 2	-	3	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	2	-	-	-	-	-	-	-	-	-
CO 4	-	-	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	3	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	3	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

The In-Plant Training course encompasses a comprehensive blend of theoretical learning and hands-on experience in an industrial setting. The course content includes:

1. Introduction to Electronics & Telecommunication Engineering Industry: Overview of different sectors, processes, and applications within the Electronics and Telecommunication engineering domain.
2. Safety Procedures and Protocols: Training on safety regulations, hazard identification, emergency procedures, and personal protective equipment (PPE) usage.
3. Equipment Familiarization: Hands-on experience with common equipment and instrumentation used in Electronics and Telecommunication engineering processes.
4. System Simulation and Optimization: Practical exercises on System simulation software and optimization techniques to enhance efficiency and productivity.
5. Troubleshooting and Maintenance: Practical sessions on diagnosing and resolving equipment malfunctions, conducting routine maintenance, and ensuring operational integrity.
6. Industrial Visits and Guest Lectures: Field trips to industrial facilities and guest lectures by industry experts to provide first hand insights into real-world applications and challenges.
7. Project Work: Collaborative projects or case studies addressing specific engineering problems or process improvements relevant to the host industry.
8. Evaluation and Assessment: Continuous evaluation based on performance during training, report submissions with the components of the report has been separately mentioned under Evaluation Method.

Evaluation Method

1. **Attendance and Participation:** Regular attendance and active participation in training sessions, workshops, and industrial visits will be monitored.
2. **Skills Assessment:** Evaluation of practical skills demonstrated during hands-on training activities, including equipment operation, experimentation, troubleshooting, and safety compliance.

3. **Performance Review:** Ongoing assessment of individual and group performance based on assigned tasks, projects, and team collaborations.
4. **Supervisor Feedback:** Feedback from industry supervisors regarding student performance, professionalism, attitude, and adaptability in the workplace.
5. **Training Report:** Submission of a comprehensive training report summarizing the learning outcomes, experiences, observations, and insights gained during the In Plant Training period.

Training Report Format: The training report should follow a structured format to ensure clarity, coherence, and completeness. Here's a suggested outline:

1. **Title Page:**
   - Title of the report: "In Plant Training Report"
   - Student's name
   - Enrolment number
   - Department/Program
   - Name of the institution
   - Duration of the training period
   - Name and address of the host industry
2. **Acknowledgments (Optional):**
   - Acknowledge any individuals, organizations, or institutions that contributed to the training experience.
3. **Table of Contents:**
   - List of sections and subsections with corresponding page numbers.
4. **Introduction:**
   - Brief overview of the training objectives, scope, and significance.
   - Description of the host industry and the specific department or division where the training was conducted.
5. **Training Objectives:**
   - Recapitulation of the objectives outlined at the beginning of the training period.
6. **Training Activities:**
   - Detailed account of the activities undertaken during the training, including:
     - Description of the tasks assigned and responsibilities undertaken.
     - Summary of workshops, seminars, industrial visits, and hands-on training sessions participated in.
     - Highlights of any notable experiences, challenges faced, and lessons learned.
7. **Skills Acquired:**
   - Discussion of the practical skills and knowledge gained throughout the training period.
   - Reflection on the application of theoretical concepts in real-world industrial scenarios.
8. **Observations and Insights:**
   - Analysis of observations made during the training, including:

- Observations regarding industry practices, processes, and technologies.
- Insights into workplace dynamics, organizational culture, and professional etiquettes.
- Suggestions for improvement or areas of further learning identified during the training.

9. **Conclusion:**
    - Summary of key takeaways and learning outcomes from the training experience.
10. **References:**
    - List of sources referenced or consulted during the preparation of the report (if applicable).
11. **Appendices (Optional):**
    - Additional materials such as photographs, diagrams, charts, or supplementary documents supporting the content of the report.
12. **Declaration:**
    - Statement affirming the authenticity and originality of the report, along with the student's signature and date.

The training report should be well-organized, concise, and professionally presented, demonstrating the student's ability to articulate their learning experiences and insights gained during the In-Plant Training period.

Reference Books	
1.	McCabe, W.L., Smith, J.C., & Harriott, P. (2018). Unit Operations of Electronics and Telecommunication Engineering
2.	Perry, R.H., & Green, D.W. (Eds.). (2018). Perry's Electronics and Telecommunication Engineers' Handbook
3.	Sinnott, R.K., & Coulson, G.F. (2012). Electronics and Telecommunication Engineering Design
4.	King, R. (2017). Safety in the Process Industries
Useful web links	
1.	www.internshala.com