Shivaji University
Vidya Nagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Second Year B. Tech (Electronics and Telecommunication Engineering), Detailed Curriculum 2024-25 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 chemical 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 chemical engineering problems.
2. **Problem Analysis Ability:** Develop skills to analyse and solve problems encountered in chemical and allied industries and consultancy services.
3. **Acquiring Skills to Design/Develop Solutions to Problems:** Design and manage chemical 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 chemical 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

Second Year B.Tech (Electronics & Telecommunication Engineering), Semester- III
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.	Basic Science Course	BSC211	Engineering Mathematics–III	03	01	-	04	04	30:70	50:00
2.	Professional Core Courses	PCC212	Electronic Circuit Design	03	-	02	05	04	30:70	00:50
3.	Professional Core Courses	PCC 213	Digital Electronics	03	-	02	05	04	30:70	00:50
4.	Professional Core Courses	PCC 214	Network Analysis	03	01	-	04	04	30:70	50:00
5.	Engineering Science Courses	ESC211	Programming Techniques	02	-	02	04	03	30:70	00:50
6.	Ability Enhancement Courses	AEC211	Soft Skills Development	01	-	-	01	01	-	50:00
							-	**20**	**500**	**300**
7.	Humanities, Social Sciences, Management, Environment	HSMEC 211	Environmental Studies	02	-	-	02	University Exam at the Even Semester End		
			Total Hours	17	02	06	**25**	-	-	-

Shivaji University, Kolhapur
Department of Technology

Second Year B. Tech (Electronics and Telecommunication Engineering), Semester- IV

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.	Basic Science Course	BSC 221	Measurements & Instrumentation	03	-	02	05	04	30:70	50:00
2.	Professional Core Course	PCC 221	Signals & Systems	03	01	-	04	04	30:70	50:00
3.	Professional Core Course	PCC 222	Analog & Digital Communication	03	-	02	05	04	30:70	00:50
4.	Professional Core Course	PCC 223	Analog Electronics	03	-	02	05	04	30:70	00:50
5.	Professional Core Course	PCC 224	Data Structures	02	01	-	03	03	30:70	00:50
6.	MDM Course	MDM 221	Multidisciplinary Minor Course I*	03	-	-	03	03	30:70	00:00
7.	Indian Knowledge Systems	IKS 221	Introduction to Performing Arts	01	-	-	01	01	-	50:00
							-	**23**	**600**	**300**
8.	Mandatory Audit Course	MAC 221	Aptitude Enhancement Course I	02	-	-	02	IE at Course in charge end		
9.	Humanities, Social Sciences, Management Environment	HSMEC 221	Environmental Studies	02	-	-	02	University Exam at the Even Semester End		
			Total Hours	22	02	06	**30**	-	-	-

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

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering), Part 2, During Semester III</td></tr>
<tr><td>Course Code</td><td colspan="5">BSC211</td></tr>
<tr><td>Course Category</td><td colspan="5">Basic Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Engineering Mathematics-III (Theory)
(Linear Algebra and Advanced Calculus)</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">Knowledge of Matrix algebra, Differential Calculus and Integral Calculus</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course offers a mathematical understanding for engineering applications. This course produce graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of engineering.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. To familiarize students with Linear algebra
2. To provide knowledge of Linear differential equations and its applications
3. To study Laplace transform and its applications
4. To study Fourier series and Fourier transform
5. To Study Vector differentiation and its applications.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Apply the knowledge of Linear algebra to solve mathematical and Engineering Problems.
2. Solve linear differential equations and apply them on simple electric circuit.
3. Gain the basic knowledge of Laplace transform and their applicability in solving initial value problems.
4. Understands the new notion of Fourier series, Fourier transform and their usability.
5. Analyze and solve engineering problems using vector differentiation.</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									
CO 2	3	3	2									
CO 3	3	3	3	3								
CO 4	3	3	3	2								
CO 5	3	3	3	3								

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

Unit No.	Course Content	Hours
1.	**Linear Algebra:** Matrix Algebra, Rank of a matrix, Normal and echelon form of a matrix, Consistency of the system of linear equations, Solution of system of linear homogeneous equations, Solution of system of linear non-homogeneous equations,Linear dependence and independence of vectors, Eigen values and Eigen vectors, Cayley-Hamilton's Theorem (Without proof).	07
2.	**Linear Differential Equations:** Linear Differential Equations with constant coefficients, Homogenous Linear differential equations, Method of variation of parameters, Applications of LDE with constant coefficients to Electrical systems.	06
3.	**Laplace Transform**: Definition- Laplace transform, Properties of Laplace transform, Laplace transform of derivatives, Laplace transform of integral, Inverse Laplace transforms, Convolution theorem, Applications to initial value boundary problems, Laplace transform of Heaviside Unit step function, Laplace transform of Dirac delta function, Laplace transform of Periodic function.	07
4.	**Fourier Series:** Fourier series ,Fourier cosine series, Fourier sine series, Half range cosine series, Half range sine series, Full range series,	07
5.	**Fourier Transform:** Fourier transforms, Fourier sine transforms, Fourier cosine transforms, Complex form of Fourier integral, Finite Fourier sine transforms, Finite Fourier cosine transforms.	06
6.	**Vector Differentiation:** Differentiation of vectors, Gradient of scalar point function, Directional derivative, Divergence of vector point function, Curl of a vector point function, Irrotational and solenoidal vector field.	06

General Instructions:

1. Each Student has to write at least 6 assignments on entire 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.	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons.
2.	B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, Delhi.
3.	N. P. Bali, Iyengar "A text book of Engineering Mathematics by", Laxmi Publications (P)Ltd., New Delhi.
4.	C. R. Wylie, "Advanced Engineering Mathematics", McGraw Hill Publication, New Delhi.
5.	H. K. Dass, "Advanced Engineering Mathematics", S. Chand Publishing.
6.	S. S. Sastry, "Engineering Mathematics (Volume-I)", Prentice Hall Publication, New Delhi.
7.	M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education.
8.	J. N. Wartikar & P. N.Wartikar , "A text book of Applied Mathematics: Vol. I, II and III" Vidyarthi Griha Prakashan, Pune.
9.	Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
Sr. No.	**Important web links**

1.	https://nptel.ac.in/courses/111105121
2.	https://nptel.ac.in/courses/111105134
3.	https://nptel.ac.in/courses/111105035
4.	https://nptel.ac.in/courses/111105167
5.	https://nptel.ac.in/courses/111102133

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<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering), Part 2, During Semester III</td></tr>
<tr><td>Course Code</td><td colspan="5">BSC211</td></tr>
<tr><td>Course Category</td><td colspan="5">Basic Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Engineering Mathematics-III (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">Knowledge of Matrix algebra, Differential Calculus and Integral Calculus</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course offers a mathematical understanding for engineering applications. This course produce graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of engineering.</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	3	3									
CO 2	3	3	2									
CO 3	3	3	3	3								
CO 4	3	3	3	2								
CO 5	3	3	3	3								

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

	Course Content	Hours
1	Introduction and Examples on Consistency of the system of linear equations	**1**
2	Examples on Linear dependence and independence of vectors	**1**
3	Introduction to Eigen values and Eigen vectors	**1**
4	Examples on Linear Differential Equations with constant coefficients	**1**
5	Applications of LDE with constant coefficients to Electrical systems	**1**
6	Examples on Properties of Laplace transform	**1**
7.	Inverse Laplace transforms	**1**
8.	Applications of Laplace transform	**1**
9.	Examples on Fourier series	**1**
10.	Introduction of Fourier transforms	**1**
11.	Examples on Fourier transforms	**1**
12.	Examples on Divergence of vector point function	**1**
13.	Examples on Curl of a vector point function	**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	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons.
2	B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, Delhi.
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2	https://nptel.ac.in/courses/111105134
3	https://nptel.ac.in/courses/111105035
4	https://nptel.ac.in/courses/111105167
5	https://nptel.ac.in/courses/111102133

Year, Program, Semester	Second Year B.Tech (Electronics & Telecommunication Engineering), Part II, Semester III				
Course Code	PCC212				
Course Category	Professional Core Courses				
Course title	Electronic Circuit Design				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	02	05	04
Evaluation Scheme	**ISE:30**			**ESE: 70**	**Total=100**
Pre-requisites (if any)	Prerequisites: Basic understanding of mathematics, physics and electronics components and familiarity with principles of science and engineering.				
Course Rationale	This course deals with design and implementation aspects of primitive power supply and amplifier circuits.				
Course Objectives	1. Understand the operation principles of half-wave, full-wave, and bridge rectifiers. 2. Design filters for unregulated power supplies. 3. Identify the need for voltage regulator circuits. 4. Understand the importance of biasing in transistor circuits. 5. Analyze clipping circuits (diode and transistor clippers) and clamping circuits. 6. Study power considerations and types of distortion in power amplifiers.				
Course Outcomes	1. Analyze and design rectifier circuits. 2. Analyze and design the unregulated power supplies. 3. Analyze and design voltage regulator circuits. 4. Describe the transistor biasing circuits. 5. Analyze and design the passive wave shaping circuits. 6. Analyze and design power amplifier circuits.				

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
PSO1	3	3	3	3	2							
PSO2	2	3	1	3	2							

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

Unit No.	Course Content	Hours
1	**Rectifier analysis and design** Half wave rectifier, full wave rectifier, bridge rectifier, analysis and comparison of different parameters like PIV, TUF, efficiency, ripple factor, regulation, etc. specifications and ratings of diodes and transformers. Design of rectifier circuits.	06
2	**Filters and unregulated power supplies** Filters, need of filters, types of filters- C filter, L filter, LC filter, CLC filter, RC filter, ripple factor and regulation based analysis, design of all filters, advantages, disadvantages and applications of unregulated power supplies , Design of unregulated power supplies with filters	06
3	**Voltage regulator circuits** Need of voltage regulator circuits, types of voltage regulators, Zener voltage regulator, transistorized shunt voltage regulator, transistorised series voltage regulator, IC voltage regulators using ICs:78XX, 79XX, IC723, LM317, Switching regulator: Introduction and study of LM3524 IC.	06
4	**Transistor Biasing** Need of biasing, DC load line analysis, operating point, thermal runaway. Analysis of different biasing circuits: fixed bias, collector to base bias & voltage divider bias. Stability factor, General expression for stability factor, design of biasing circuits, Compensation techniques: Thermistor and diode compensation, CE, CB & CC configurations, Design of Single stage RC coupled amplifier.	06
5	**Wave Shaping Circuits** Low pass & high pass RC circuits (square & step response), High pass RC circuit as a differentiator, Low pass RC circuit as integrator. Clipping circuits: Classification, diode clippers transistor clippers, Transfer characteristics, Design & analysis of clipper circuits. Clamping circuits: Classification, clamping operations, Clamping circuit theorem, practical clamping circuits. Voltage multipliers: Doubbler, Trippler & Qudrappler circuits.	06
6	**Power Amplifiers** Need of Power amplifier, classification of power amplifier, Power considerations, Distortion in power amplifiers: Phase, Frequency, amplitude/ harmonic /nonlinear distortion, amplitude distortion using Three-point method. Class A single ended transformer coupled amplifier& class A Push pull amplifiers analysis and design, Class B amplifier & class B push pull amplifier analysis & design, crossover distortion, class AB Push pull amplifiers analysis and design Complementary symmetry power amplifier, class C amplifier.	06
Sr.No.	**Text Books**	
1.	J. B. Gupta, 'Electronics Devices and Circuits' , Katson Books	
Sr. No.	**Reference Books**	

1.	Robert L. Boylsted, Louis Nashelsky- 'Electronic devices & circuit theory'- 9th edition- Pearson Education
2.	vid A. Bell –'Electronic devices & circuits'- 4th Edition- Prentice- Hall India
3.	anufacturer data sheets
Sr. No.	**Important web links**
1	https://www.electronics-tutorials.ws/

Year, Program, Semester	Second Year B.Tech (Electronics & Telecommunication Engineering), Part II, Semester III						
Course Code	PCC212						
Course Category	Professional Core Courses						
Course title	Electronic Circuit Design Lab						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	-	02	02		01	
Evaluation Scheme	**ISI**	**ESE**	**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	-	**-**	**-**	**-**	**-**	**50**	**50**
Pre-requisites (if any)	Prerequisites: Basic understanding of mathematics, physics and electronics components and familiarity with principles of science and engineering.						
Course Rationale	This course deals with design and implementation aspects of primitive power supply and amplifier circuits.						
Course Objectives	1. Design of the rectifier. 2. Illustrate properties of unregulated power supply. 3. Discuss the need of regulated power supply. 4. Discuss the need of transistor biasing. 5. Discuss the need of wave shaping circuits 6. Discuss the working principle of power amplifiers.						
Course Outcomes	1. Analyze and design rectifier circuits 2. Analyze and design the unregulated power supplies. 3. Analyze and design voltage regulator circuits. 4. Design Single stage RC coupled amplifier. 5. Design the wave shaping circuits. 6. Analyze and design power amplifiers.						

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
PSO1	3	3	3	3	2							
PSO2	2	3	1	3	2							

Expt. No.	Course Content
1	Design & analysis of Half wave rectifier (HWR) with & without filter by calculating performance parameters.
2	Design & analysis of Full wave rectifier (FWR) with & without filter by calculating performance parameters.
3	Design & analysis of Bridge rectifier with & without filter by calculating performance parameters.
4	Design & analysis of C, L, LC, CLC filter.
5	Design & analysis of fixed voltage regulator.
6	Design & analysis of adjustable voltage regulator.
7	Design and analysis of single stage RC coupled CE amplifier.
8	Design and analysis of series and parallel clippers.
9	Design and analysis of positive and negative clampers.
10	Design and analysis of RC low pass filter as an integrator.
11	Design and analysis of RC high pass filter as differentiator.
12	Design and analysis of Class A power amplifier.
13	Design and analysis of Class B power amplifier.
14	Design and analysis of Class AB power amplifier.
Sr. No.	**Text Books**
1	J. B. Gupta, 'Electronics Devices and Circuits' , Katson Books
Sr. No.	**Reference Books**
1	Robert L. Boylsted, Louis Nashelsky- 'Electronic devices & circuit theory'- 9th edition-Pearson Education

2	David A. Bell –'Electronic devices & circuits'- 4th Edition- Prentice- Hall India
3	Manufacturer data sheets
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1	https://www.electronics-tutorials.ws/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering),
Part 2, Semester III</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 213</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Digital 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>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">Knowledge of basic Mathematics</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Digital Electronics course is designed to provide students with a fundamental understanding of the principles, theories, and applications of digital circuits and systems. In today's technologically driven world, digital electronics form the backbone of numerous devices and systems, ranging from computers to embedded systems. This course aims to equip students with the knowledge and skills required to design, analyze, and troubleshoot digital circuits, laying the foundation for careers in fields such as electronics, computer engineering, and information technology.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Introduce fundamental concept of digital techniques.
2. Enhance basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
3. Conduct the analysis and design of various digital electronic circuits.
4. Develop a skill to build and troubleshoot digital circuits.
5. Introduce to simulation tools for digital electronics</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Understand number systems and its arithmetic operations and Illustrate use of Boolean algebra.
2. Formulate and apply Karnaugh Map to reduce Boolean expressions and logic circuits to their simplest forms.
3. Design and analyse of different combinational circuits.
4. Understand working of flip-flops and apply conversion of flip flops
5. Design and analyse of sequential circuits.
6. Understand logic families and Remembering concept of memory technology</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**											**3**	
CO 2	**3**	**3**	**3**	**1**									**3**	
CO 3	**3**	**3**	**3**	**1**	**1**								**3**	**3**
CO 4	**3**	**3**	**1**	**1**									**3**	**3**
CO 5	**3**	**3**	**3**	**1**	**1**								**3**	**3**
CO 6	**3**												**1**	

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

Unit No.	Course Content	urs
1	**Binary Codes and Boolean algebra** Binary Number System. Addition, Subtraction, Multiplication, Division of binary numbers, Subtraction using 2's complement method. Binary codes: weighted and non weighted codes, self complementary codes, BCD, Gray codes, Alphanumeric codes, ASCII Codes. Boolean algebra: Boolean Laws and Expression using Logic Gates, Realization of different gates using Universal gates, De-Morgan's Theorem, Duality Theorems.	**06**
2	**Boolean Function minimization Techniques** Standard forms: SOP, POS, Simplification of Switching function & representation (Maxterm & Minterm), Boolean expression & representation using logic gates, Propagation delay in logic gate. Karnaugh map: K-map, mapping and minimization of SOP and POS expression, Don't care condition, conversion from SOP to POS and POS to SOP form using K-map, Minimization of multiple output circuits	**06**
3	**Combinational Circuits Design** Adder & Subtractor(Half and Full), Parallel Binary adder, BCD Adder, Code Converters, Comparators, Decoder, BCD to 7-segment Decoder, Encoders, Priority Encoders, Multiplexers, De Multiplexers	**06**
4	**Sequential Circuits Elements** Introduction to sequential circuit, Flip-flop & Timing Circuits: SR latch, Gated latch, Tri state logic, Edge triggered flip-plop: - D, JK, T Flip-flop, flip-flop asynchronous inputs ,characteristic table of Flip-flop, excitation table of Flip-flop, master slave JK flip flop, inter conversion of Flip-flop.	**06**
5	**Shift Registers and Counters** Shift registers: buffer register, controlled buffer register. Data transmission in shift resistor SISO, SIPO, PISO, PIPO, Bidirectional shift register, universal shift registers. Counter: Classification, Ripple or asynchronous counter, Effect of propagation delay in ripple counters, up-down counter, Design of Mod-n counter, synchronous counter, Ring counter, Johnson counter.	**06**
6	**Logic Families and Memory Technology** Digital IC specification terminology, Logic families: TTL, CMOS families, comparison of TTL & CMOS, Memory Technology: Memory organization, Classification of Memory.	**06**
No.	**ference Books**	

1	M. Morris Mano ‘Digital Design’ (Third Edition). PHI Publications
2	Willim I. Fletcher.’An Engineering Approach to Digital Design’ PHI
3	Norman Balabanian Bradle Carlson. ‘Digital Logic Design Principals.’ Wiley Publication.
4	Rajkamal ‘Digital Systems Principals and Design’ Pearson Education
5	A.P. Malvino, D.P. Leach ‘Digital Principles & Applicatios’ -VIth Edition-TMH publication.
6	A. Anand Kumar ‘Fundamentals of Digital Circuits’. PHI Publications
7	R.P. Jain-‘Modern Digital Electronics’ IIIrd Edition- Tata Mc Graw Hill, Publication
Sr. No.	**portant web links**
1	https://onlinecourses.nptel.ac.in/noc24_ee52/preview

Year, Program, Semester	Second Year B.Tech (Electronics & Telecommunication Engineering), Part 2, During Semester III						
Course Code	PCC 213						
Course Category	Professional Core Courses						
Course title	**Digital Electronics Laboratory**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	-	02	02		01	
Evaluation Scheme	**ISI**	**ESE**	**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	-	**-**	**-**	**-**	**-**	**50**	**50**
Pre-requisites (if any)	Knowledge of basic Mathematics						
Course Rationale	The Digital Electronics course is designed to provide students with a fundamental understanding of the principles, theories, and applications of digital circuits and systems. In today's technologically driven world, digital electronics form the backbone of numerous devices and systems, ranging from computers to embedded systems. This course aims to equip students with the knowledge and skills required to design, analyze, and troubleshoot digital circuits, laying the foundation for careers in fields such as electronics, computer engineering, and information technology.						
Course Objectives	1. Introduce fundamental concept of digital techniques. 2. Enhance basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits. 3. Conduct the analysis and design of various digital electronic circuits. 4. Develop a skill to build and troubleshoot digital circuits.						
Course Outcomes	1. Understand number systems and its arithmetic operations and Illustrate use of Boolean algebra. 2. Formulate and apply Karnaugh Map to reduce Boolean expressions and logic circuits to their simplest forms. 3. Design and analyse of different combinational circuits. 4. Understand working of flip-flops and apply conversion of flip flops 5. Design and analyse of sequential circuits. **6.** Understand logic families and Remembering concept of memory technology						

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
PSO1	3	3	3	3	2							

PSO2	2	3	1	3	2							

	List of Experiments 1. Study of basic gates 2. Study of Universal gates (NAND, NOR) 3. K map based implementation of combinational logic 4. Half and Full Adder, Half and Full Subtractor 5. 4- bit parallel Adder / Subtractor using IC 7483 6.Code Converters (Binary to Gray, Excess 3 to Binary) 7. Comparator using IC 7485 8. Implementation of combinational logic using MUX 9. Study of Decoder and DEMUX (IC 74138) 10. Study of 7 segment decoder driver. (IC 7447) 11. Study of Flip Flops (SR FF, D FF, JK FF, T FF) 12. Design Built and test MOD N counter 13. Design Built and test Shift Register 14. Design and implementation of Johnson Counter Design 3 bit sequence detector **Minimum eight experiments should be conducted from above list or based on syllabus.**

Sr. No.	**Reference Books**
1.	M. Morris Mano 'Digital Design' (Third Edition). PHI Publications
2.	Willim I. Fletcher.'An Engineering Approach to Digital Design' PHI
3.	Norman Balabanian Bradle Carlson. 'Digital Logic Design Principals.' Wiley Publication.
4.	Rajkamal 'Digital Systems Principals and Design' Pearson Education
5.	A.P. Malvino, D.P. Leach 'Digital Principles & Applicatios' -VIth Edition-TMH publication.
6.	A. Anand Kumar 'Fundamentals of Digital Circuits'. PHI Publications
7.	R.P. Jain-'Modern Digital Electronics' IIIrd Edition- Tata Mc Graw Hill, Publication
Sr. No.	**Important web links**
1.	https://onlinecourses.nptel.ac.in/noc24_ee52/preview

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering), Part 2, During Semester III</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC214</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Network Analysis</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">Prerequisites for this course typically include Engineering Mathematics I and II, Electronic devices and circuits</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course will give fundamental knowledge of linear electronic circuits , the network theorems , two-port networks , filters , attenuators and their analysis.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. To introduce basic theorems used for network analysis.
2. To teach two port networks and its parameters.
3. To clarify series and parallel resonance and its use.
4. To demonstrate response of RL,RC and RLC circuits
5. To impart design methods for filters
6. To impart design methods for attenuators</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Apply appropriate network theorem to find circuit solution.
2. Understand resonant circuits.
3. Analyze circuit using different network theorems.
4. Calculate parameters of two port network.
5. Understand the step input response in RL,RC and RLC circuits
6. Design different filters and attenuator</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	**PO4**	PO	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2
CO 1	3	1											3	
CO 2	3	3	3	1									3	
CO 3	3	3	3	1	1								3	3
CO 4	3	3	1	1									3	3
CO5	3	3	3	1	1								3	3
CO6	3												1	

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

Unit No.	Course Content	urs
1	**Circuit Fundamentals** Voltage sources, Current sources, Conversion of voltage sources to current sources and vice a versa. Network terminology :- Node ,Junction, Branch, Loop, Network solution by branch current method, Loop or Mesh current method, Node voltage method, Star delta connection and conversion Network Theorems:-Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Superposition Theorem, Millman's theorem	**06**
2	**Resonance Circuits** Series resonance circuit, Frequency response of a series resonant circuit, Effect of Q on bandwidth and selectivity, Relation between bandwidth and Q, Impedance of a series resonant circuit, Resonance by variation of L and C, Parallel resonant circuit	**06**
3	**Two-Port Networks** Two- port network parameters: y, z, h, A B C D Inter-conversion of two port networks, cascade connection series connection, series parallel connection, T and π network representation of a two port network.	**06**
4	**Network Functions** Transform of circuit elements, Network functions, Stability, Transient response: - step input response in R-L circuit, step input response in R-C circuit, step input response in R-L- C circuit	**06**
5	**Filters** Definitions, classification and characteristics of different filters, decibel, neper. Design and analysis of constant K filter (low pass, high pass, band pass, and band stop filters): T and PI sections	**06**
6	**Attenuators** Definitions, classification, relation between neper and decibel, analysis and design of T type, π type, lattice, bridged –T and L types attenuators	**06**

No.	Reference Books
1	A.Sudhakar, Shymmohan S. Palli, 'Circuit and Network – Analysis and Synthesis', 3rd Edition, Tata McGraw Hill Publication
2	D. Roy Choudhuri, 'Networks and Systems', New Age International Publisher.
3	A. Chakrabarti, 'Circuit theory (Analysis and Synthesis)', IIIrd edition, Dhanpat Rai and Co.
4	M.E.Van Valkenburg, 'Network Analysis', IIIrd edition, Pear sons Education/PHI.

5	Josheph Edministrar, 'Theory and Problems of Electronic Circuit (Schaum's Series) – Tata McGraw Hill Publication.
6	Soni Gupta, 'Electrical Circuit Analysis', Dhanpat Rai and Co.
Sr. No.	**Important web links**
1	https://onlinecourses.nptel.ac.in/noc22_ee07/preview
2	https://www.youtube.com/watch?v=7Nh7ISeqn6E&list=PLbRMhDVUMngfNnABo5mre45ZbHqJE2sUn

Year, Program, Semester	Second Year B.Tech (Electronics & Telecommunication Engineering), Part 2, During Semester III						
Course Code	PCC214						
Course Category	Professional Core Courses						
Course title	**Network Analysis Tutorial**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	01	-	01		01	
Evaluation Scheme	**ISI**	**ESE**	**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	-	**-**	**50**	**-**	**-**	**-**	**50**
Pre-requisites (if any)	Prerequisites for this course typically include Engineering Mathematics I and II, Electronic devices and circuits						
Course Rationale	This course will give fundamental knowledge of linear electronic circuits , the network theorems , two-port networks , filters , attenuators and their analysis.						
Course Objectives	1. To introduce basic theorems used for network analysis. 2. To teach two port networks and its parameters. 3. To clarify series and parallel resonance and its use. 4. To demonstrate response of RL,RC and RLC circuits 5. To impart design methods for filters 6. To impart design methods for attenuators						
Course Outcomes	1. Apply appropriate network theorem to find circuit solution. 2. Understand resonant circuits. 3. Analyze circuit using different network theorems. 4. Calculate parameters of two port network. 5. Understand the step input response in RL,RC and RLC circuits 6. Design different filters and attenuator						

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	**PO4**	PO	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2
CO 1	3	1											3	
CO 2	3	3	3	1									3	
CO 3	3	3	3	1	1								3	3
CO 4	3	3	1	1									3	3
CO5	3	3	3	1	1								3	3
CO6	3												1	

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

Sr.No.	Title of Tutorials
1.	Problems based on star and delta connections and their conversions
2.	Problems based on energy source transformations
3.	Problems based on series and parallel resonance circuits
4.	Problems based on z parameters of two –port networks
5.	Problems based on y parameters of two –port networks
6.	Problems based on h parameters of two –port networks
6.	Problems based on ABCD parameters of two –port networks

Sr.No.	**Reference Books**
1	A.Sudhakar, Shymmohan S. Palli, 'Circuit and Network – Analysis and Synthesis', 3rd Edition, Tata McGraw Hill Publication
2	D. Roy Choudhuri, 'Networks and Systems', New Age International Publisher.
3	A. Chakrabarti, 'Circuit theory (Analysis and Synthesis)', IIIrd edition, Dhanpat Rai and Co.
4	M.E.Van Valkenburg, 'Network Analysis', IIIrd edition, Pear sons Education/PHI.
5	Josheph Edministrar, 'Theory and Problems of Electronic Circuit (Schaum's Series) – Tata McGraw Hill Publication.
6.	Soni Gupta, 'Electrical Circuit Analysis', Dhanpat Rai and Co.
Sr. No.	**Important web links**
1	https://onlinecourses.nptel.ac.in/noc22_ee07/preview
2	https://www.youtube.com/watch?v=7Nh7ISeqn6E&list=PLbRMhDVUMngfNnABo5mre45ZbHqJE2sUn

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Part 2, Semester III</td></tr>
<tr><td>Course Code</td><td colspan="5">ESC211</td></tr>
<tr><td>Course Category</td><td colspan="5">Engineering Science Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Programming Techniques</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>02</td><td>04</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">Basics of computer fundamentals, C Programming</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course intends to teach the students the basic concepts of object-oriented programming (OOP) that can be applied to solve real world problems. Because of complex nature of real world problems, programs are prone to error and programming errors can become expensive. Object-Oriented Programming offers a new and powerful way to coupe with this complexity. Its goal is clearer, more reliable, more easily maintained programs. This course will act as backbone for all other subjects that are based on Object Oriented concept.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Explain the basic concepts and techniques which form the object oriented programming paradigm.
2. Strengthen their problem solving ability by applying the characteristics of an object-oriented approach.
3. Introduce object oriented concepts in C++.
4. Elaborate fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
5. Help to implement the object oriented concepts to solve problems
6. Demonstrate to develop an application applying the object oriented concepts</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Explain what constitutes an object-oriented approach to programming and identify potential benefits of object-oriented programming over other approaches.
2. Apply an object-oriented approach to developing applications of varying complexities.
3. Take a problem and develop the structures to represent objects and the algorithms to perform operations.
4. Apply standards and principles to write truly readable code.
5. Test a program and, if necessary, find mistakes in the program and correct them.
6. Develop applications using object oriented concepts</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	**PO4**	PO	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2
CO 1	3	1											3	
CO 2	3	3	2	1									2	
CO 3	3	2	3	1	1								3	3
CO 4	3	3	1	1									2	1
CO5	3	3	2	1	1								3	3
CO6	3												1	

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

Unit No.	Course Content	Hours
1	**Introduction to Object Oriented Programming Language.** Introduction to Procedural, Object oriented programming Language. Characteristics and applications of OOP, advantages of OOP over procedural programming, fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism. Functions in C++, Function prototype, call by value, call by reference, inline function, default & constant argument.	**06**
2	**Classes and Objects** Definition of a class, Declaring classes and object, Access specifiers: public, private, protected, defining member functions inside or outside class. Nesting of member functions, Private Member function, making outside function inline. Arrays within a Class, Memory allocation for objects. Static data member, Static member functions. Array of Objects & Passing Objects as Function Arguments in C++.	**06**
3	**Constructors & Destructors** Overview of constructors and destructors, Purpose and significance in C++ programming. Basic syntax and usage. Types of constructors: Default Constructors, Parameterized Constructors, Copy Constructors. Constructor overloading. Introduction to destructors, Role in resource management and clean-up.	**06**

4	**Polymorphism & Inheritance** Need of Polymorphism, concept, Compile time polymorphism or early binding: function over loading and operator overloading, operator overloading using member function and friend function, overloading - unary, binary, arithmetic operators, relational operators, Overloading new and delete operators, insertion and extraction operators, Run time polymorphism or late binding using Virtual function, pure virtual function, Abstract class, Type conversion. Need of Inheritance, Concept, public, private, protected inheritance, Single inheritance, Multiple and multilevel inheritance, Hybrid Inheritance, Virtual base class, overriding of member functions, static variable, static function, friend function, friend class.	**06**
5	**Pointers** Definition and purpose of pointers. Understanding memory addresses and variables. Basic syntax for declaring and using pointers. Pointer Operations: Dereferencing pointers to access data. Pointers and arrays: relationship and equivalence. Accessing array elements using pointers. Pointers basics of memory management, dynamic memory allocation using New and delete operators, Pointer to object, Pointer to data members, this pointer. Pointer to derived class.	**06**
6	**File handling & exception handling, STL** Introduction to file handling in C++ Opening and closing files, File streams: ifstream, ofstream, and fstream File modes: input, output, append. Reading from Files, Writing to Files File, Input/output Operations Exception handling: Introduction, syntax for exception handling code: trycatch-throw, Multiple Exceptions, Exceptions with arguments Exception Handling, STL: An overview, containers, vectors, lists, maps.	**06**

Sr. No.	**Text/reference Books**
1	E Balgurusamy –'Object oriented programming with C++' -, IInd Edition- Tata McGraw Hill Publication
2	Y Kanetkar- 'Let Us C++', BPB Publications
3	Herbert Schildt –'The Complete Reference C++' - IIIrd Edition - Tata McGraw Hill Publication
4	Ravichandran D.-'Programming with C++ '-IInd Edition- Tata McGraw Hill Publication
5	Robert Lafore –'C++ Programming' –. IV th Edition –Techmedia, New Delhi
Sr. No.	**Important web links**
1	https://www.geeksforgeeks.org/cpp-tutorial/
2	https://www.javatpoint.com/cpp-tutorial

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<tr><td>Year,
Program,
Semester</td><td colspan="7">Second Year B.Tech (Electronics & Telecommunication Engineering), Part II, Semester III</td></tr>
<tr><td>Course Code</td><td colspan="7">ESC211</td></tr>
<tr><td>Course Category</td><td colspan="7">Engineering Science Courses</td></tr>
<tr><td>Course title</td><td colspan="7">Programming Techniques Laboratory</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>02</td><td colspan="2">02</td><td colspan="2">01</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISI</td><td>ESE</td><td colspan="2">IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="2">-</td><td>-</td><td>-</td><td>50</td><td>50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="7">Basics of computer fundamentals, C Programming</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The C++ Object-Oriented Programming (OOP) laboratory course aims to provide hands-on experience in applying the principles and features of object-
oriented programming using the C++ language.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">1. Understanding of the core concepts of object-oriented programming
2. Understanding Classes and Objects
3. Implementing Different Types of Constructors
4. Understanding Polymorphism and Inheritance
5. Understand how pointers can be used as function arguments to pass data by reference
6. Exploring File Stream Modes and Error Handling:</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">1.Implement class attributes and methods to encapsulate data and behavior effectively.
2.Proficiency in Class Definition and Object Creation
3.Knowledge of Constructor and Destructor Invocation
4.Proficiency in Designing Class Hierarchies
5.Proficiency in Function Pointers
6.Practicing File Reading and Writing</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
PSO1	3	3	3	3	2							
PSO2	2	3	1	3	2							

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

List of Experiments

Sr.No.	Tittle
1.	Introduction to C++ programming Setting up IDEs (Integrated Development Environments) like Code::Blocks, Visual Studio, or any other preferred IDE.
2.	Exploring different data types and variable manipulation.
3.	Understanding and implementing various operators and expressions.
4.	Manipulating arrays and strings.
5.	Defining and calling functions with different parameter passing methods.
6.	Implementing structures and classes with their member functions.
7.	Introduction to classes and objects.
8.	Implementing constructors, destructors, and member functions.
9.	Implement function overloading with different argument types and/or number.
10.	Implement inheritance types: public, private, and protected.
11.	Declare friend functions and classes to access private members of a class.
12.	Utilizing pointers and managing dynamic memory.
13.	File Handling: Reading from and writing to files.
14.	Use exception handling mechanisms in member functions.

Sr. No.	Text/reference Books
1.	E Balgurusamy –'Object oriented programming with C++' -, IInd Edition- Tata McGraw Hill Publication
2.	Y Kanetkar- 'Let Us C++', BPB Publications
3.	Herbert Schildt –'The Complete Reference C++' - IIIrd Edition - Tata McGraw Hill Publication
4.	Ravichandran D.-'Programming with C++ '-IInd Edition- Tata McGraw Hill Publication
5.	Robert Lafore –'C++ Programming' –. IV th Edition –Techmedia, New Delhi
Sr. No.	**Important web links**
1.	https://www.geeksforgeeks.org/cpp-tutorial/

Year, Program, Semester	Part 2, Semester III				
Course Code	AEC211				
Course Category	Ability Enhancement Courses				
Course title	**Soft Skill Development**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	01	-	-	01	01
Evaluation Scheme	**IE:50**			**EE: 00**	**Total=50**
Pre-requisites (if any)	H.S.C. Level English Language competency				
Course Rationale	In today's competitive professional landscape, technical skills alone are insufficient. Soft skills such as communication, teamwork, problem-solving, and adaptability are essential for engineering graduates to thrive in their careers. This course aims to equip students with the necessary soft skills to complement their technical expertise and enhance their employability and success in the workplace.				
Course Objectives	The teacher will 1. Help to enhance communication, teamwork, problem-solving skills. 2. Help to foster adaptability and resilience in engineering contexts				
Course Outcomes	At the end of the course, the students will be- 1. Proficient in oral and written communication. 2. Effective as regards teamwork and collaboration skills. 3. Able to apply critical thinking to industrial problems. 4. Able to demonstrate adaptability and resilience in profession.				

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	-	-	-	-	-	-	-	-	3	3	-	-
CO 2	-	-	-	-	-	-	-	-	3	-	-	-
CO 3	-	3	-	-	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	-	-	2

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

Unit No.	Course Content	Hours
1	**Written communication** • Email Writing • Technical Report	**03**
2	**Oral Communication** • Presentation Skills	**02**
3	**Soft Skills** • Importance of Soft Skills • Overview of Various Soft Skills	**02**
4	**Team Spirit & Leadership Ability** • Understanding team dynamics and roles • Building trust and rapport within team	**02**
5	**Assessment** • Discussion on incorporating soft skills development into daily practice • Case Studies or Role-Play	**05**
Sr. No.	**Text/reference Books**	
1	Sharma R. & Krishna Mohan (2017), Business Correspondence and Report Writing, McGraw Hill Education	
2	P. D. Chaturvedi & Mukesh Chaturvedi (2013), *Business Communication: Skills, Concepts & Applications*, Pearson Publications, New Delhi, 3rd Edition, Seventh Impression	

3	K. K. Sinha (2006), *Business Communication*, 2nd Edition (Reprint), Galgotia Publishing, New Delhi
4	Khera, S. (1998). "You Can Win: A Step by Step Tool for Top Achievers." New Delhi: Macmillan Publishers India.
5	Covey, S. R. (2004). "The 7 Habits of Highly Effective People." New York: Free Press.
6	Carnegie, D. (2009). "How to Win Friends and Influence People." New York: Pocket Books.
7	Bradberry, T., & Greaves, J. (2009). "Emotional Intelligence 2.0." San Diego, CA: TalentSmart.
8	Dweck, C. S. (2006). "Mindset: The New Psychology of Success." New York: Ballantine Books.

Course Assessment Method

For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. Following Evaluation Components are suggested:

1. **Quizzes/Tests**
   Periodic quizzes or tests to evaluate students' understanding of key concepts and their ability to apply them.

2. **Activity 1**
   Group activity focusing application of creative thinking and teamwork; designed to assess both individual and group performance

3. **Activity 2**
   Group activity focusing application of creative thinking and teamwork; designed to assess both individual and group performance

4. **Classroom Participation and Engagement**
   Demonstrating engagement with course material and Active participation in class discussions, group activities and question-answer sessions.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">2024-25 Semester III</td></tr>
<tr><td>Course Code</td><td colspan="5">HSMEC211</td></tr>
<tr><td>Course Category</td><td colspan="5">Humanities, Social Science, Management, Environment</td></tr>
<tr><td>Course title</td><td colspan="5">Environmental Studies</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></td></tr>
<tr><td>02</td><td>-</td><td>-</td><td>02</td><td></td></tr>
<tr><td>Evaluation Scheme</td><td colspan="5">SEE: 70 Marks + IOE: 30 Marks, evaluation only at Even Semester End.</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Course is all about learning the way we should live and how we can develop sustainable strategies to protect the environment. It helps individuals to develop an understanding of living and physical environment and how to resolve challenging environmental issues affecting nature.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will
1. Introduce students to the fundamental concepts and principles of environmental science.
2. Describe the components of various ecosystems and their interrelationships.
3. Classify different types of natural resources and assess their availability and distribution.
4. Define biodiversity and its significance to ecosystem functioning and human well-being.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to –
1. Define key terms and concepts related to environmental science.
2. Analyse ecosystem services and their importance to human well-being.
3. Identify various types of natural resources and their significance.
4. Describe the levels and patterns of biodiversity and their importance.</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
CO1	3	2	-	-	-	-	3	3	-	-	-	-
CO2	-	3	3	-	-	-	3	3	3	2	-	-
CO3	-	2	3	-	-	-	3	3	3	3	-	-
CO4	-	2	-	-	-	-	3	3	3	3	-	-

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

Unit No.	Course Content	Hours
1	**Nature of Environmental Science** Definition, scope and importance. Multidisciplinary nature of environmental studies Need for public awareness. Introduction to sustainable development: Sustainable Development Goals (SDGs) -targets and indicators, challenges and strategies for SDGs.	04
2	**Ecosystem** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession.Food chains, food webs and ecological pyramids, Introduction, types, characteristics features, structure and function of the Following ecosystem: -Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquaticecosystems (ponds, streams, lakes, rivers, oceans, estuaries) Degradation of ecosystems and its impacts.	06
3	**Natural Resources and Associated Problems** Overview of natural resources: Definition of resource; Classification of natural resources-biotic and abiotic, renewable and non-renewable. Forest resources: Use and over-exploitation, deforestation, dams and their effectson forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Water scarcity and stress; Conflicts over water. Soil and Mineral resources: Soil as resource and its degradation , Usage and exploitation, Environmental effects of extracting and using mineral resources., Wasteland reclamation, Energy resources: Growing energy needs, renewable and non- renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclearenergy, Role of Indian traditions and culture in conservation of the environment	08

4	**Biodiversity and its conservation** Introduction- Definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega- diversity nation. Western Ghats as a biodiversity region. Hot-spots of biodiversity, Threats to biodiversity habitat loss, poaching of wildlife, man- wildlife, Conflicts, Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone	**07**

Sr.	**Text Books**
1	Agarwal, K. C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2	Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 380013, India.
3	Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc,
	Text/reference Books
1	Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. ,2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
2	Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press.
3	Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).
4	Heywood, V. H. & Watson, R. T., 1995, Global Biodiversity Assessment, Cambridge Univ. Press.
5	Jadhav, H. & Bhosale, V. M., 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi.
6	Mckinney, M. L. & Schocl. R. M. ,1996, Environmental Science Systems & Solutions, Web enhanced edition
	Important web links

1	https://onlinecourses.swayam2.ac.in/cec19_bt03/previewrwrr3
2	http://nitttrc.edu.in/nptel/courses/video/109105203/L41.html

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering),
Part 2, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="5">BSC 221</td></tr>
<tr><td>Course Category</td><td colspan="5">Basic Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Measurements and Instrumentation</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"></td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Measurements and Instrumentation course is designed to provide students with a foundational understanding of the principles, techniques, and instruments used in the field of measurements. In engineering and scientific disciplines, accurate and precise measurements are essential for analysis, control, and optimization of various processes. This course aims to equip students with the theoretical knowledge and practical skills needed to perform accurate measurements and effectively use instrumentation in diverse applications. Through this course, students will develop a strong foundation for pursuing advanced studies and careers in fields such as electrical engineering, physics, and related disciplines.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Introduce students to the fundamental concepts of measurements, including units, standards, and measurement errors.
2. Familiarize students with the principles of instrumentation and measurement devices.
3. Provide an in-depth understanding of sensors and transducers used for converting physical quantities into measurable electrical signals.
4. Explore techniques for conditioning signals from sensors and transducers.
5. Introduce students to data acquisition systems for capturing, storing, and processing measurement data.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Explain fundamental principles of measurement and instrumentation.
2. Identify and use different type’s transducers for various measurement applications.
3. Evaluate the selection criteria for choosing specific AC or DC Bridge in different applications.
4. Demonstrate different types of display devices and oscilloscopes and handling these instruments.
5. Demonstrate different signal generators and spectrum analyser.
6. Describe the components and functions of data acquisition 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	PSO 1	PSO 2
CO 1	3	1											3	2
CO 2	3	3	3	1									3	3
CO 3	3	3	3	1	1								2	
CO 4	3	3	1	1										
CO 5	3	3	3	1	1									
CO 6	3												2	

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

Unit No.	Course Content	Hours
1	**Introduction to Measurements Systems and Measuring Instruments** Measurements, elements of generalized measurement system, measurement system performance, static and dynamic characteristic, Errors- Types & source of error. Dual Slope Integrating type DVM, digital frequency meter, Q meter, phase measurement.	04
2	**Transducers** Definition, classification, transducer selection, different types of transducers, strain gauges, RTD, thermistor, thermocouple, LVDT, capacitive transducers, piezoelectric transducer, photovoltaic cell, LDR, Elastic pressure transducer – bellows, bourdon tubes, ultrasonic transducers – level measurement	08
3	**AC and DC Bridges** DC bridges: Introduction, wheatstone's bridge, Kelvin bridge, guarded Wheatstone bridge, AC bridges: Condition for bridge balance .Maxwell bridge, Hay bridge, Schering bridge, wein bridge.	06
4	**Oscilloscope & Display Devices** Introduction of Dual Beam and dual trace oscilloscope , Sampling, Digital storage, digital readout, measurement of phase and frequency using Lissajous pattern, CRO probes, Display devices: classification of display devices & principle: LED,LCD	06
5	**Signal Generators and Analyzers** Signal generators: Function generators, Sweep, pulse and square wave generator. Wave Analyzers: basic wave analyzer, heterodyne harmonic distortion analyzer, spectrum analyzer, logic analyser.	06
6	**Data Acquisition System and Conversion** Introduction, Objective of DAS, ,Single channel & Multichannel DAS ,DAC concepts: Binary weighted DAC, R-2R ladder circuit DAC, ADC concepts: flash, single slope, dual slope, stair case Ramp ADC, successive approximation ADC, Data Loggers	06

Sr. No.	Reference Books
1	A.K.Sawhney 'A Course in Electrical & Electronics Measurement & Instrumentation.' –11th Edition, 1996 --Dhanpat Rai & sons
2	C.S. Rangan ,G.R. Sharma , V.S.V. Mani 'Instrumentation devices and system' 2nd edition --Tata McGraw Hill Publication
3	B.C.Nakra, K.K.Choudhary 'Instrumentation, Measurement and Analysis', 2nd edition -- Tata McGraw Hill Publication
4	E.O.Doebeline.'Measurement systems application and design 'Tata McGraw Hill Publication
5	Oliver Cage 'Electronic measurement and instrumentation 'Tata McGraw Hill PublicationPublishers.
6	H .S. Kalsi 'Elecronic Instrumentation' – 2nd edition --Tata McGraw Hill Publication
7	A. D. Helfrick , W. D. Cooper ' Modern Electronic Instrumentation and Measurement Techniques'--Pearson Education
Sr. No.	**Important web links**
1	https://onlinecourses.nptel.ac.in/noc24_me12/preview

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">Second Year B.Tech (Electronics & Telecommunication Engineering),
Part 2, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="7">BSC 221</td></tr>
<tr><td>Course Category</td><td colspan="7">Basic Science Course</td></tr>
<tr><td>Course title</td><td colspan="7">Measurements and Instrumentation Laboratory</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>02</td><td colspan="2">02</td><td colspan="2">01</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISI</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>50</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="7"></td></tr>
<tr><td>Course Rationale</td><td colspan="7">This course deals with analysis and design of various digital electronic circuits with its applications.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">1. Specify clear objectives for measurements based on the properties of the physical quantity being measured.
2. Choose appropriate instruments for specific measurement tasks.
3. Perform calibration procedures for various instruments.
4. Set up and configure data acquisition systems.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">1. Explain fundamental principles of measurement and instrumentation.
2. Identify and use different type’s transducers for various measurement applications.
3. Evaluate the selection criteria for choosing specific AC or DC Bridge in different applications.
4. Demonstrate different types of display devices and oscilloscopes and handling these instruments.
5. Demonstrate different signal generators and spectrum analyser.
6. Describe the components and functions of data acquisition systems.</td></tr>
</table>

	List of Experiments **1.** Study of temperature transducers: a) RTD b) Thermocouple c) Thermistor **2.** Study of displacement transducers: a) Inductive b) Capacitive c) Resistive **3.** Study of weight measurement using strain gauge: **4.** Study of speed measurement using : a) Magnetic pick up b) Photoelectric pick up **5.** Study of AC and DC bridges: a) Wheastones' bridge b) Maxwell's bridge c) Wein bridge **6.** Measurement of frequency and phase using Lissageous patterns **7.** Study of digital storage oscilloscope **8.** Study of spectrum analyzer **9.** Study of pressure measurement using bourdon tube **10.** Study of DAC using R-2R ladder network

Sr. No.	**Reference Books**
1	A.K.Sawhney 'A Course in Electrical & Electronics Measurement & Instrumentation.' – 11th Edition, 1996 --Dhanpat Rai & sons
2	C.S. Rangan ,G.R. Sharma , V.S.V. Mani 'Instrumentation devices and system' 2nd edition --Tata McGraw Hill Publication
3	B.C.Nakra, K.K.Choudhary 'Instrumentation, Measurement and Analysis', 2nd edition -- Tata McGraw Hill Publication
4	E.O.Doebeline.'Measurement systems application and design 'Tata McGraw Hill Publication
5	Oliver Cage 'Electronic measurement and instrumentation 'Tata McGraw Hill PublicationPublishers.
6	H .S. Kalsi 'Elecronic Instrumentation' – 2nd edition --Tata McGraw Hill Publication
7	A. D. Helfrick , W. D. Cooper ' Modern Electronic Instrumentation and Measurement Techniques'-- Pearson Education

Sr. No.	Important web links
1	https://onlinecourses.nptel.ac.in/noc24_me12/preview
2.	https://www.udemy.com/course/electronic-measurements-and-instrumentation/?utm_source=adwords&utm_medium=udemyads&utm_campaign=DSA_Catchall_la.EN_cc.INDIA&utm_content=deal4584&utm_term=_.ag_82569850245_.ad_533220805574_.kw_.de_c_.dm_.pl_.ti_dsa-21781902600_.li_9146233_.pd_.&matchtype=&gad_source=1&gclid=CjwKCAiAivGuBhBEEiwAWiFmYXAIWhj2TLlhm3TFFSlbmrGOXGKs3X9IchTQR8PLJ_M25NqgNyt4aRoC79cQAvD_BwE&couponCode=IND21PM

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering), Part 2, During Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 221</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Signals and 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>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">Differential Equations, Laplace Transform, z-Transform.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">In typical applications of science and engineering, we have to process signals, using systems. The applications may vary from communication systems to control systems, but the basic analysis and design tools can be common. In this course, we are going to study all the fundamental mathematical signal processing tools like convolution, Fourier analysis, Laplace and Z transform. Main aim of the course is to study the use of these said tools in the analysis of linear time-invariant (LTI) systems. This course is fundamental course in the field of Signal Processing. This course builds concrete base for advanced courses like Digital Signal Processing, Audio and Speech Signal Processing, Image processing, Biomedical signal processing etc.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Explain classification of continuous and discrete time signals and systems
2. Demonstrate Analysis and Characterization of the CT and DT systems through Time domain method.
3. Discuss Spectral analysis of CT periodic and aperiodic signals using CT Fourier methods.
4. Explain Characterization of the CT systems through Laplace Transform and Fourier Transform.
5. Explain Analysis and Characterization of the DT systems through Z Transform.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Differentiate between different types of signals.
2. Identify type of Systems.
3. Analyze LTI systems in time domain.
4. Apply Fourier techniques to transform the signals in frequency domain.
5. Analyze LTI systems using Laplace transform and Z- transforms.
6. Demonstrate signals and interdependencies of time and frequency domain parameters.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3		PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													3	
CO 2	3	1												3	2
CO 3	3	2	1		2									3	2
CO 4	3	3	1		2									3	2
CO 5	3	3	1		2									3	2
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 Signals:** Signals, Continuous and discrete time signals, Classification of Signals , Periodic aperiodic, even & odd energy and power signals, deterministic and random signals, complex exponential and sinusoidal signals , periodicity properties of discrete time signals, complex exponential, unit impulse, unit step, impulse functions, transformation of independent variable.	**05**
2	**Systems and Time domain analysis** Properties of systems: Linearity, Causality, Time invariance, Stability, Invertability. Time domain analysis of LTI systems: System modeling, Solution of Differential equation with initial conditions, Zero state response and Zero input response, representation of LTI system by impulse response (continuous and discrete Convolution), Identifying properties of system from impulse	**08**
3	**Frequency domain Analysis of systems** Fourier series representation of continuous time and discrete time periodic signals (Exponential), properties of continuous time and discrete time Fourier series. Continuous time and discrete time Fourier Transform, properties of the CT and DT Fourier Transform, Characterization using differential and difference equation, Parseval's relation, convolution in time and frequency domains, applications of Fourier transform.	**08**
4	**Sampling Theorem** Representation of continuous time signals by its sample, Sampling theorem, aliasing effect, antialiasing , methods reconstruction of a Signal from its samples, Interpolation techniques, discrete time processing of continuous time signals, sampling of band pass signals.	**03**
5	**Laplace Transform** Introduction, pole-zero plot, ROC, Properties of Laplace Transform, Inverse Laplace transform using partial fraction method, transfer function of LTI-CT system, impulse response and transfer function, convolution and de-convolution using LT, stability in S domain, system realization of LTI system in S domain. Application: solution of electronics circuit, solution of differential equation.	**08**
6	**Z-Transform** Basic principles of z-transform, z-transform definition, region of convergence, properties of ROC, Properties of z-transform, Poles and Zeros, inverse z-transform using residue Theorem, power Series expansion and partial fraction expansion, Computation of Impulse response & Transfer	**07**

	function using Z Transform, stability of LTI Systems, system realization of LTI system in Z domain. Applications: solution of difference equation.	

Sr. No.	Reference Books
1	Nagoor Kani, “Signals & Systems”, Tata McGraw Hill
2	Anand Kumar, “Signals & Systems”, PHI
3	AlanV.Oppenheim, Alan S.Willsky with S.Hamid Nawab, “Signals & Systems”, Pearson Education.
4	K.Lindner, “Signals and Systems”, McGraw Hill International, 1999.
5	Michael J. Roberts “Fundamentals of signals & systems”, Tata McGraw Hill, 2007
Sr. No.	**Important web links**
1	https://onlinecourses.nptel.ac.in/noc24_ee36/preview

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering), Part 2, During Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 221</td></tr>
<tr><td>Course Category</td><td colspan="5">Compulsory Course for Certification in Electronics & Telecommunication Engineering</td></tr>
<tr><td>Course title</td><td colspan="5">Signals and 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="3">---</td><td>IE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Basic programming, MATLAB.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">In typical applications of science and engineering, we have to process signals, using systems. The applications may vary from communication systems to control systems, but the basic analysis and design tools can be common. In this course, we are going to study all the fundamental mathematical signal processing tools like convolution, Fourier analysis, Laplace and Z transform. Main aim of the course is to study the use of these said tools in the analysis of linear time-invariant (LTI) systems. This course is fundamental course in the field of Signal Processing. This course builds concrete base for advanced courses like Digital Signal Processing, Audio and Speech Signal Processing, Image processing, Biomedical signal processing etc.</td></tr>
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3.Discuss Spectral analysis of CT periodic and aperiodic signals using CT Fourier methods.
4.Explain Characterization of the CT systems through Laplace Transform and Fourier Transform.
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<tr><td>Course Outcomes</td><td colspan="5">1.Differentiate between different types of signals.
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Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3												3	
CO 2	3	1											3	2
CO 3	3	2	1	2									3	2
CO 4	3	3	1	2									3	2
CO 5	3	3	1	2									3	2
CO 6	3	2			1								3	2

Level of Mapping as: Low 1, Moderate 2,

Minimum 8 Tutorials should be carried out based on following list or Syllabus

	Course Content	**Hours**
1.	Introduction to MATLAB. Different operators and commands in MATLAB.	01
2.	Generation of Different Continuous Time (CT) and Discrete time (DT) signals	01
3.	Convolution of CT and DT signals	01
4.	Generation of Exponential and Trigonometric Fourier series of Periodic Signal	01
5.	Fourier Transform and IFT of signals. Effect of Time and Frequency Domain.	01
6.	Verification of sampling theorem	01
7.	Reconstruction of Signals	01
8.	Reconstruction of Signals	01
9.	Determination of Laplace transform of signals and verification of properties of LT.	01
10.	Determination of Z- transform of signals and verification of properties of ZT.	01
11.	Pole zero plots.	01
12.	Introduction to SIMULINK.	01
Sr. No.	**Reference Books**	
1	Nagoor Kani, “Signals & Systems”, Tata McGraw Hill	
2	Anand Kumar, “Signals & Systems”, PHI	
3	AlanV.Oppenheim, Alan S.Willsky with S.Hamid Nawab, “Signals & Systems”, Pearson Education.	
4	K.Lindner, “Signals and Systems”, McGraw Hill International, 1999.	
5	Michael J. Roberts “Fundamentals of signals & systems”, Tata McGraw Hill, 2007	
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<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering), Part 2, During Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 222</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Analog and Digital 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>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">Electronic Circuit Design</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course aims to enable students to be familiar with fundamental concepts and issues, to develop good understanding of basic analogue and digital communication techniques, to perform simple analysis and assessment of system performance.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. To study the fundamental concept of the analog communication systems.
2. To introduce the concepts of angle modulation.
3. To understand the working of various receivers.
4. Explain various waveform coding techniques.
5. To introduce the baseband data communication
6. To understand digital modulation techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of the course students will be able to -
1. Illustrate the principles of amplitude modulation.
2. Analyze and compare angle modulation techniques
3. Differentiate types of receivers used for particular application.
4. Analyse the performance of waveform coding techniques
5. Evaluate baseband data communication techniques.
6. Compare bandpass digital modulation techniques</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2									3	2
CO 2	3	2	1	2									3	1
CO 3	3	2	1	2									3	2
CO 4	3	2	1	2									3	
CO 5	3	2	1	2									3	
CO 6	3	2	1	2									3	

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

Unit No.	Course Content	Hours
1	**Amplitude Modulation** Block schematic of communication system, Necessity of modulation, Types of modulation – AM, FM, PM and Pulse Modulation. Noise , Amplitude Modulation (AM) Techniques, Modulation index, % modulation, Power relations in AM,AM Generation: Low level and High Level Modulation, Modulator Circuits, Balanced modulator , SSB Principle, Vestigial sideband(VSB)	07
2	**Angle Modulation** Theory of Angle Modulation Techniques, FM and Phase Modulation(PM), Frequency deviation and Percentage Modulation, Deviation Sensitivity, Deviation ratio, Phase Deviation and Modulation Index, Bandwidth Requirements , FM Modulators(Direct & Indirect methods)	05
3	**Receivers** Types: TRF and Superhetrodyne ,Receiver Parameters: Sensitivity, Selectivity, Bandwidth, Dynamic Range, Fidelity, AM Detection : Using Diode, Practical Diode Detector FM receiver -Block diagram, Comparison with AM Receivers, Basic FM Demodulators.	06
4	**Waveform Coding** Sampling theorem and recovery of original signal, Quantization – Uniform & Non uniform , PCM, DPCM, need of predictors, implementation of predictors at transmitter, Bandwidth requirement in each system, Delta Modulation, limitations of DM, ADM, comparison between DM, PCM and ADM.	07
5	**Baseband Data Communication** Introduction, Baseband pulse shaping, Shaping of transmitted spectrum, Baseband signal receiver: Integrate and Dump filter, optimum filter, matched filter transfer function, correlate filter transfer function, Inter symbol interference.	04

6	**Digital Modulation Schemes** ASK, PSK, FSK, DPSK, QPSK, QAM, coherent and non-coherent detection, Probability of errors and comparison of noise performances in ASK, FSK, PSK.	**07**

Sr. No.	**Reference Books**
1	Wayne Tomasi, 'Electronics Communication Systems Fundamentals through Advanced' - Pearson Education.
2	George Kennedy, 'Electronics Communication System'--Tata McGraw Hill Publication.
3	Louis E. Frenzel, 'Principles of Electronic Communication Systems' -Tata McGraw Hill Publication.
4	Dennis Roddy, John Coolen, 'Electronics Communications '4th Edition-Pearson Education
5	Taub & Schling, "Principles of Communication System" TMH 2.
6	Apurba Das, "Digital Communication: Principles and System Modelling", Springer Publications
7	K. Sam Shanmugan, "Digital & Analog Communication systems" Wiley Publication
8	B.P. Lathi, " Modern Digital & Analog Communication System" Oxford University Press
9	Siman Haykin, "Digital Communication ", Wiley Publication
10	Bernard Scalar, "Digital Communication Fundamentals & Applications" PHI
Sr. No.	**Important web links**
1	https://onlinecourses.nptel.ac.in/noc21_ee74/preview
2	https://nptel.ac.in/courses/117101051

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B. Tech (Electronics & Telecommunication Engineering), Part 2, During Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 222</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Analog and Digital Communication Laboratory</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="3"></td><td>EE: 50</td><td>Total=50</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 aims to enable students to be familiar with fundamental concepts and issues, to develop good understanding of basic analogue and digital communication techniques, to perform simple analysis and assessment of system performance.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1.To study the fundamental concept of the analog communication systems.
2.To introduce the concepts of angle modulation.
3.To understand the working of various receivers.
4.Explain various waveform coding techniques.
5.To introduce the baseband data communication
6.To understand digital modulation techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of the course students will be able to -
1.Illustrate the principles of amplitude modulation.
2.Analyze and compare angle modulation techniques
3.Differentiate types of receivers used for particular application.
4. Analyse the performance of waveform coding techniques
5. Evaluate baseband data communication techniques.
6. Compare bandpass digital modulation techniques</td></tr>
</table>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2									3	3
CO 2	3	2	1	2									3	2
CO 3	3	2	1	2									3	1
CO 4	3	2	1	2									3	
CO 5	3	2	1	2									3	
CO 6	3	2	1	2									3	

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

Expt. No.	**Course Content**
1	Study of Amplitude Modulation (A.M.)
2	Study of Frequency Modulation.(F.M.)
3	Study of AM Detection.
4	Study of SSB Modulation & Demodulation.
5	Study of DSB Modulation & Demodulation.
6	Study of FM Demodulation.
7	Sampling and Reconstruction.
8	Study of Pulse Amplitude Modulation & Demodulation.
9	Study of Pulse Width Modulation& Demodulation.
10	Study of Pulse Position Modulation & Demodulation
11	Experiment on ASK Modulation and Demodulation
12	Study of FSK Modulation and Demodulation
13	Study of PSK Modulation and Demodulation
14	Study of QPSK Modulation and Demodulation
15	Study of Delta Modulation and Demodulation
16	Study of Adaptive Delta Modulation and Demodulation
17	Study of TDM-PCM Modulation and Demodulation
18	Study of DPCM Modulation and Demodulation
19	Visit to radio station (AM/FM)
General Instruction: Minimum 8 experiments should be conducted from above experiment list or based on the syllabus	
Sr. No.	**Reference Books**
1	Wayne Tomasi, 'Electronics Communication Systems Fundamentals through Advanced' - Pearson Education.

2	George Kennedy, 'Electronics Communication System'--Tata McGraw Hill Publication.
3	Louis E. Frenzel, 'Principles of Electronic Communication Systems' -Tata McGraw Hill Publication
4	Dennis Roddy, John Coolen, 'Electronics Communications '4th Edition-Pearson Education
5	Taub & Schling, "Principles of Communication System" TMH 2.
6	Apurba Das, "Digital Communication: Principles and System Modelling", Springer Publications
7	K. Sam Shanmugan, "Digital & Analog Communication systems" Wiley Publication
8	B.P. Lathi, " Modern Digital & Analog Communication System" Oxford University Press
9	Siman Haykin, "Digital Communication ", Wiley Publication
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Sr. No.	**Important web links**
1	https://onlinecourses.nptel.ac.in/noc21_ee74/preview
2	https://nptel.ac.in/courses/117101051

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<tr><td>Course Code</td><td colspan="5">PCC 223</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Analog 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>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">Basic knowledge of electronic Devices like R,L,C, BJT, Diode etc</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Analog Circuits plays a vital role in the design of an electronic system. This course is detail study of important Analog / Linear Integrated Circuits (ICs). This course is a Circuit Design course planned to give exposure on use of operational amplifier (Op. Amp.) For Different applications and its significance in real world. It also includes other Analog ICs like Timer IC 555 and PLL.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1.Impart information about OPAMP 741 internal circuit and characteristics.
2.Explore OPAMP parameters
3.Explore OPAMP frequency response
4.Discuss OPAMP linear and nonlinear applications
5.Discuss OPAMP based filters and signal generator
6.Explore linear IC PLL and Timer 555</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1.Analyze the internal circuits of op. amp. 741.
2.Analyze the op. amp. For different Parameters.
3.Analyze linear and non-linear applications of op. amp.
4.Describe the open loop and closed loop frequency response of op. amp.
5.Design Filter and Signal generator circuits using op. amp.
6.Describe the PLL and Timer IC with application circuits.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	P PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3													
CO 2	3	1											2	
CO 3	3				2									
CO 4	3	3			2								2	
CO 5	3	3			2									
CO 6	3	3			2									

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

Unit No.	Course Content	Hours
1	**Op-Amp basics and Characteristics** Differential amplifier: common mode, differential mode, configurations, DC and AC analysis, constant current bias, current mirror circuit, cascade diff-amp stages, level shifter. Block Diagram of Op-Amp, Study of µA 741: Ideal & Practical Op-amp specifications, Transfer characteristics of Op amp.	**08**
2	**Op-Amp Parameters and basic Configurations** Op. Amp. Parameters: offset voltages and offset currents with compensation techniques, Input Bias current, slew rate, CMRR, PSRR, Thermal drift, open loop gain, closed loop gain, Comparative study of OP 07, LM 741, LM 311. Open Loop & Closed Loop Inverting, Non inverting and Differential amplifier with analysis of parameters like Av, Ri, Ro, Bandwidth.	**05**
3	**Op-Amp frequency response** Open loop and closed loop frequency response, unity gain BW, need for compensation, Internal and external compensated op amps and frequency response, effect of slew rate.	**06**
4	**Op-Amp Applications** Summing amplifier, Subtractor, Integrator, Differentiator, Instrumentation Amplifier, I to V and V to I converters. Comparators, Zero Crossing Detector, Window detector, Schmitt trigger, peak detector, log and antilog amplifier, precision rectifier, sample and hold circuit, clippers and clampers.	**08**
5	**Op-Amp Active Filters and signal generators** Filters: First & Second Order Butterworth Low Pass, High Pass, Band Pass, Band Reject and All Pass Filters. Signal generators: RC phase Shift, Wein Bridge, Hartely, Colpitts oscillators, op amp as multivibrators and triangular wave generators.	**05**
6	**PLL and Timer** Phase Lock Loop: Introduction, Operating principle, Study of Block Diagram of PLL, case study IC 565 PLL and application, Timer IC 555: block diagram, IC 555 as astable, mono-stable, bi-stable multivibrators, VCO.	**07**
Sr. No.	**Reference Books**	

1	J. Michael. Jacob —Application & Design with Analog Integrated Circuits, PHI.
2	Ramakant. A.Gayakwad — Op-Amps & Linear Integrated Circuits, 3rd Edition, PHI.
3	S.Salivahanan & Bhaaskaran —Linear Integrated Circuits, 1st Edition, Tata McGraw Hill
4	Sergio Franco —Design with op-amp & Analog Integrated Circuits, Tata McGraw Hill.
Sr. No.	**Important web links**
1	https://archive.nptel.ac.in/courses/108/108/108108111/
2	https://archive.nptel.ac.in/courses/108/108/108108114/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering), Part 2, During Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 223</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Analog Electronics lab</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="3"></td><td>EE: 50</td><td>Total=50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Basic knowledge of electronic Devices like R,L,C, BJT, Diode etc</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Analog Circuits plays a vital role in the design of an electronic system. This course is detail study of important Analog / Linear Integrated Circuits (ICs). This course is a Circuit Design course planned to give exposure on use of operational amplifier (Op. Amp.) For Different applications and its significance in real world. It also includes other Analog ICs like Timer IC 555 and PLL.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Demonstrate linear application of op amp.
2. Demonstrate Non-linear application of op amp.
3. Demonstrate filter circuits using op amp.
4. Demonstrate measurement of op amp parameters.
5. Demonstrate oscillator using op amp.
6. Demonstrate application circuit using 555.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Design and implement linear application of op amp.
2. Design and implement Non-linear application of op amp.
3. Design and implement filter circuits using op amp.
4. Demonstrate measurement of op amp parameters.
5. Design and implement oscillator using op amp.
6. Design and implement application circuit using 555.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	P PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO 2	3	1											2	
CO 3	3				2									
CO 4	3	3			2								2	
CO 5	3	3			2									
CO 6	3	3			2									

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

Expt.No.	List of Experiments	Hours
1	Study of Inverting amplifier for DC & AC inputs using opamp	
2		
3	Study of Non-Inverting amplifier for DC & AC inputs using opamp	
4	Frequency Response of Inverting & Non-Inverting amplifier using opamp	
5	Study of op-amp as Summing, Scaling, & Averaging amplifier in Inverting & Non-Inverting	
6	Study of Instrumentation Amplifier using LM 324	
7	Study of V-I & I-V Converter	
8	Study of Schmitt Trigger using opamp & Window detector using opamp	
9	Study of Comparator & Zero Crossing Detector using opamp	
10	Study of Precision Rectifier using opamp	
11	Study of Butterworth Filter using opamp	
12	Study of Triangular & square wave generator using opamp	
13	Design of IC 555 Timer as Astable & Monostable Multivibrator	
14	Study of IC NE 565 PLL	
15	Study of Weins Bridge Oscillator using opamp	
16	Study of Function Generator using IC 8038	

Sr.No.	Reference Books
1	J. Michael. Jacob —Application & Design with Analog Integrated Circuits, PHI.
2	Ramakant. A.Gayakwad — Op-Amps & Linear Integrated Circuits, 3rd Edition, PHI.
3	S.Salivahanan & Bhaaskaran —Linear Integrated Circuits, 1st Edition, Tata McGraw Hill
4	Sergio Franco —Design with op-amp & Analog Integrated Circuits, Tata McGraw Hill.
Sr. No.	**Important web links**

1	https://archive.nptel.ac.in/courses/108/108/108108111/
2	https://archive.nptel.ac.in/courses/108/108/108108114/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Second Year B.Tech (Electronics & Telecommunication Engineering), Part I, Semester III</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 224</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Data Structures</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>01</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: Basics of computer fundamentals, Programming knowledge of C and C++ language.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course helps student in understanding logical & mathematical models of storing & organizing data in a particular way in a processor-based system. In system programming, application programming the methods & techniques of data structures are widely used. The study of data structure helps the students in developing logical & structured programs.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. Inculcate basic principles and concepts of data structures in student.
2. Familiarize students with commonly used data structures and their associated algorithms used in industry.
3. Introduce techniques for efficient storage, manipulation and retrieval of data using data structures.
4. Apply data structures and algorithms to solve programming problems efficiently.
5. Enhance problem-solving skills through practical implementation and programming assignments.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. Develop knowledge of basic data structures for storage and retrieval of ordered or unordered data.
2. Implement linked list data structure to solve various problems.
3. Understand and apply linear data structure such as stacks, queues to solve various computing problems.
4. Identify problems that can be solved using tree structures and apply appropriate tree-based algorithms to solve them effectively
5. Implement basic graph operations, such as adding and removing vertices and edges, and perform operations like traversals and topological sorting
6. Analyze the time and space complexities of searching and sorting algorithms and understand factors influencing algorithm efficiency, including algorithm design, input size, and data distribution</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	P PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO 2	3	1											2	
CO 3	3				2									
CO 4	3	3			2								2	
CO 5	3	3			2									
CO 6	3	3			2									

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

Unit No.	Course Content	Hours
1	**Introduction to Data Structures** Data types– primitive and non-primitive, Types of Data Structures, Linear & non-linear Data Structures, Arrays: Definition, One Dimensional Array and Multidimensional Arrays Strings: Definition, Library Functions of Strings, Basics of Algorithms, the time and space complexity of algorithms using asymptotic notation, Abstract Data Type (ADT).	04
2	**Linear Data Structure: Linked List** Introduction to linked list, Representation of Linked Lists in Memory, Singly Linked List, Doubly Linked List, Circular Linked List, Circular, Operations on linked list: Traversal, Searching node, Inserting node, Deleting node, Concatenation, Applications of Linked List: Representation & manipulations of polynomials using linked lists.	06
3	**Linear Data Structures: Stack and Queue** Stack: Introduction, Array Representation of Stack, Linked Representation of Stack, Applications of stack:, Expression conversion (Conversion of Infix to prefix and postfix expression) and Evaluation, Quicksort, Recursion, etc. Queue: Introduction, Array Representation of Queue, Linked list representation of Queue, Types of Queues: Circular Queue, Priority Queue, Dequeue, double ended queue, Applications of Queue.	08
4	**Nonlinear Data Structure: Tree**	06

	Introduction, Binary Tree: Binary tree representation in Memory, Binary tree traversal algorithms (Preorder, Inorder, Postorder), Threaded Binary tree, Binary Search Tree: operations (Searching, Insertion, Deletion), AVL Search Trees: Definition, Representation of an AVL search tree, Operations – Insertion, Deletion. B-Trees: Definition, Representation of B trees, Operation: Insertion, deletion and searching. Applications: Huffman coding	
5	**Nonlinear Data Structure: Graphs** Basic concepts, Sequential representation of Graph: Adjacency Matrix, Path Matrix, Linked representation of graph Operation on graphs: Traversal techniques (BFS and DFS), Searching, Insertion. Applications of Graphs -Topological sorting.	**06**
6	**Searching and Sorting Algorithms** Searching: Importance of searching, Linear Search, Binary Search, complexity of searching algorithms. Sorting: Importance of Sorting, Quick sort, Selection sort, Bubble sort, Insertion Sort, Merge Sort, Radix sort, Complexity of sorting algorithms. Hashing: Hash Functions, Overflow handling, Collision & Collision Resolution Techniques, (chaining, open addressing).	**06**

Sr. No.	**Text Books**
1	S. Lipschutz , 'Data Structures with C', Tata McGraw-Hill
2	Horowitz Ellis, Sahani –'Fundamentals of Data Structures in C++' -, Universities Press Publication
3	Richard F. Gilberg and Behrouz A. Forouzon, 'Data Structures- A Pseudocode Approach with C', Cengage Learning 2rd 2004 2 Data
4	Rajesh K. Shukla, "Data Structure Using C and C++" Wiley Dreamtech Publication
Sr. No.	**Reference Books**
1.	Michael T Goodrich –'Data Structures and Algorithms in C++' – 2nd Edition –Wiley Publication
2.	Mark Allen Weiss -' Data Structures and Algorithm Analysis in C++ '-3rd Edition - Pearson Publication
3.	J. R. Hubbard – 'SCHAUM'S OUTLINE OF DATA STRUCTURES WITH C++ '–. 1st Edition – McGraw Hill Education
4.	Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++", PHI Learning Private Limited, Delhi India
Sr. No.	**Important web links**
1	https://www.sanfoundry.com/cpp-programming-examples-data-structures/
2	https://www.geeksforgeeks.org/data-structures/

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">Second Year B.Tech (Electronics & Telecommunication Engineering), Part II, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="7">PCC 224</td></tr>
<tr><td>Course Category</td><td colspan="7">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="7">Data Structures Tutorial</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>01</td><td>-</td><td colspan="2">01</td><td colspan="2">01</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISI</td><td>ESE</td><td>IOE</td><td>IPE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>50</td><td>50</td></tr>
<tr><td>Pre-requisites</td><td colspan="7">Prerequisites: Basics of computer fundamentals, Programming knowledge of C and C++ language.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">This course helps student in understanding logical & mathematical models of storing & organizing data in a particular way in a processor-based system. In system programming, application programming the methods & techniques of data structures are widely used. The study of data structure helps the students in developing logical & structured programs.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">1. Inculcate basic principles and concepts of data structures in student.
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<tr><td>Course Outcomes</td><td colspan="7">1. Develop knowledge of basic data structures for storage and retrieval of ordered or unordered data.
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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	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
PSO1	3	3	3	3	2							
PSO2	2	3	1	3	2							

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

Lab No.	**Lab Title**
1	Array operations
2	Linear and Binary Search Techniques
3	Factorial and Fibonacci Series with and without Recursion
4	Insertion, deletion and traversal operations on singly linked list
5	Insertion, deletion and traversal operations on doubly linked list
6	Implementation of Stack using arrays and linked list
7	Sorting Techniques (Bubble sort, Quick sort, Merge sort)
8	Operation on Queue (Enqueue and Dequeue)
9	Binary tree traversal (Pre-order, Post-order, In-order traversal)

10	Insertion, traversal, search operations on Binary Search tree.
Sr. No.	**Text Books**
1	S. Lipschutz , 'Data Structures with C', Tata McGraw-Hill
2	Horowitz Ellis, Sahani –'Fundamentals of Data Structures in C++' -, Universities Press Publication
3	Richard F. Gilberg and Behrouz A. Forouzon, 'Data Structures- A Pseudocode Approach with C', Cengage Learning 2rd 2004 2 Data
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2	https://www.geeksforgeeks.org/data-structures/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">2024-25 Second Year B.Tech (Electronics & Telecommunication Engineering), Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="5">IKS 221</td></tr>
<tr><td>Course Category</td><td colspan="5">Indian Knowledge System</td></tr>
<tr><td>Course title</td><td colspan="5">Introduction to Performing Arts</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 rowspan="2">Evaluation Scheme</td><td colspan="2">I8SE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>50</td><td></td><td>50</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course "Introduction to Performing Arts" seeks to broaden the horizons of engineering students by integrating the rich and diverse realm of performing arts into their curriculum. By exploring various performing arts forms, students will not only develop a deeper understanding of human expression but also enhance their creativity, communication skills, and cultural awareness. This interdisciplinary approach aligns with NEP 2020's vision of holistic education and fosters the development of well-rounded individuals equipped to thrive in a rapidly evolving world.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure
1. Introduce fundamental concepts, history, and theoretical frameworks of various performing arts forms.
2. Cultivate appreciation for cultural, social, and aesthetic dimensions of performing arts.
3. Develop critical thinking and analytical skills through performance analysis.
4. Enhance communication and presentation skills through practical exercises.
5. Foster creativity and imagination through exploration of diverse performing arts mediums.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, students will be able to
1. Identify and analyze key elements and techniques across theater, dance, music, and visual arts.
2. Demonstrate understanding of historical, cultural, and social contexts in performing arts.
3. Critically evaluate performances using appropriate terminology.</td></tr>
</table>

	4. Apply performance principles to effectively communicate ideas and emotions. 5. Engage in creative expression through original performances.

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	-	2	-	2	-	-	-	-	-
CO 2	-	-	-	-	-	3	2	-	-	-	-	-
CO 3	-	-	-	-	-	-	2	-	3	3	-	-
CO4	-	-	-	-	-	2	-	2	3	3	-	-
CO5	-	-	-	-	-	-	-	-	-	-	3	-

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

Unit No.	Course Content	Hours
1	Foundations of Performing Arts • Introduction to Performing Arts: Definition, scope, and significance. • Historical overview: Evolution of performing arts across cultures and civilizations.	**02**
2	Theatrical Arts • Introduction to theater: Origins, elements, and dramatic conventions. • Major theatrical movements and styles: Realism, surrealism, absurdism, etc. • Analysis of selected plays and playwrights.	**03**
3	Dance Forms • Introduction to dance: Styles, techniques, and cultural contexts. • Exploration of classical, folk, and contemporary dance forms. • Practical exercises and choreography workshops. .	**03**
4	Musical Expressions Introduction to music: Basic principles, genres, and traditions. • Appreciation of classical, folk, and popular music styles. Analysis of musical compositions and performances	**02**

5	Visual Performing Arts • Introduction to visual arts in performance: Set design, costume, and makeup. • Role of visual elements in enhancing the theatrical experience. • Case studies and practical demonstrations.	**02**
6	Performance and Presentation • Practical application of performing arts principles: Group performances and presentations. • Rehearsal techniques, stage presence, and audience engagement. Reflection and feedback on individual and group performances.	**02**

Assessment

For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. Following Evaluation Components are suggested:

- Written Assignments: 20 Marks
- Practical Assessments: 20 Marks
- Class Participation and Engagement: 10 Marks

Sr. No.	**Reference Books**
1	Bharata Muni, *Natyashastra*, An ancient Indian treatise on performing arts covering various aspects of classical dance, music, and drama, composed between 200 BCE and 200 CE, influencing the theory and practice of Indian performing arts for centuries.
2	Girish Karnad. (2005). Collected Plays: Volume 1. Oxford University Press.
3	Mohan Khokar. (2000). Traditions of Indian Classical Dance. Clarion Books.
4	Sunil Kothari. (2001). Kathak, Indian Classical Dance Art. Abhinav Publications. .

5	Sangeet Natak Akademi. (2005). Indian Music: Tradition and Trends. Sangeet Natak Akademi.
6	P. Sambamurthy. (2010). South Indian Music, Vol. 1. The Indian Music Publishing House.
7	Kapila Vatsyayan. (2007). Indian Classical Dance: Tradition in Transition. Publications Division, Ministry of Information and Broadcasting, Government of India.
8	Vijay Tendulkar. (2010). Collected Plays in Translation. Oxford University Press.

Sr. No.	**Important web links**
1	https://www.youtube.com/watch?v=W7bEzgZrN7s
2	https://www.youtube.com/watch?v=DQbNpx_CfJY
3	https://www.youtube.com/watch?v=eGiz50aVYWQ

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">2024-25 Second Year B.Tech (Electronics & Telecommunication Engineering), Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="5">MAC 221</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 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>02</td><td>-</td><td>-</td><td>02</td><td>00</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="5">IE at course end</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This Aptitude Enhancement Course I aims to nurture holistic development among second-year B. Tech. Engineering students by focusing on enhancing their critical thinking, problem-solving skills, creativity, and emotional intelligence. Aligned with the NEP 2020 and Outcome-Based Education (OBE) philosophy, the course seeks to empower students with essential aptitudes required for success in both academic and professional domains.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1.The course teacher will ensure to-
2.Equip students with critical thinking skills through analytical exercises and problem-solving tasks.
3.foster creativity and innovation by engaging students in structured workshops and practical projects.
4.Develop students' emotional intelligence through self-awareness activities and stress management techniques.
5.Enhance collaborative skills and effective communication through group discussions and team-based projects.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">1. By the end of the course, the students will be able to
2. Demonstrate proficiency in critical thinking by analysing complex problems and proposing effective solutions.
3. Exhibit creativity through the development of innovative projects and solutions.
4. Display heightened emotional intelligence by managing stress, communicating empathetically, and resolving conflicts constructively.
5. Showcase collaborative skills by actively participating in group activities, contributing to team goals, and communicating ideas effectively.</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	-	-
CO 2	-	2	-	-	2	1	-	-	-	-	-	-
CO 3	-	-	-	-	-	3	2	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	3	3	2	1

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

Unit No.	Course Content	Hours
1	Inter-Personal & Inter-Organizational Communication	**02**
2	Creative & Critical Thinking	**02**
3	Group Dynamics & Decision-Making Techniques .	**02**
4	Emotional Intelligence & Stress Management Strategies	**03**
5	Assessment	**05**

Assessment

For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. The assessment will focus real-world scenarios that require the application of critical thinking, problem-solving, creativity, emotional intelligence, and teamwork. Following Evaluation Components are suggested:

1. Activity 1- Group Presentation (20 marks)

2. Activity 2- Group Discussion (20 marks)

3. Classroom Participation and Engagement (10 marks)
   Active participation in class discussions, group activities and question-answer sessions.

Sr. No.	Reference Books

1	Chakravarthi T. Kalyana and Chakravarthi T. Latha, *Soft Skills for Managers* (Biztantra Publications, 2014 (ISBN: 978-81-7722-568-6))
2	Kumar Sanjay and Pushp Lata (2015), *Communication Skills*, 2nd Edition, Oxford University Press, (ISBN: 9780199457069)
3	P. D. Chaturvedi and Mukesh Chaturvedi (2017), *The Art and Science of Business Communication- Skills, Concepts, Cases and Applications*, 4th Edition, Pearson India Education Services Pvt. Ltd., (ISBN 978-93-325-8728-1)
4	Wright, L. (2001). Critical Thinking: An Introduction to Analytical Reading and Reasoning. Oxford University Press.
5	Kallet, M. (2014). Think Smarter: Critical Thinking to Improve Problem-Solving and Decision-Making Skills. Wiley.
6	Bradberry, T., & Greaves, J. (2009). Emotional Intelligence 2.0. TalentSmart.
7	Dweck, C. S. (2007). Mindset: The New Psychology of Success. Ballantine Books.
Sr. No.	**Important web links**
1	https://www.sanfoundry.com/cpp-programming-examples-data-structures/
2	https://www.geeksforgeeks.org/data-structures/

<table>
<tr><td>Year, Program, Semester</td><td colspan="4">2024-25 Second Year B.Tech (Electronics & Telecommunication Engineering), Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="4">HSMEC 221</td></tr>
<tr><td>Course Category</td><td colspan="4">Humanities, Social Science, Management, Environment</td></tr>
<tr><td>Course title</td><td colspan="4">Environmental Studies</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>2</td><td>-</td><td>-</td><td>02</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="4">SEE: 70 Marks + IOE: 30 Marks, evaluation only at Even Semester End.</td></tr>
<tr><td>Course Rationale</td><td colspan="4">The Course is all about learning the way we should live and how we can develop sustainable strategies to protect the environment. It helps individuals to develop an understanding of living and physical environment and how to resolve challenging environmental issues affecting nature.</td></tr>
<tr><td>Course Objectives</td><td colspan="4">The course teacher will -
1. Describe the various types and sources of environmental pollution.
2. Explore other global environmental issues, such as biodiversity loss, deforestation, and ocean acidification.
3. Explain key environmental laws and regulations at the national and international levels.
4. Explain the relationship between human society and the environment.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">Upon completion of this course, student should be able to –

1. Classify different types of environmental pollutants and their sources.
2. Analyze the interconnections between climate change and other global environmental issues.
3. Understand the legal frameworks and regulations governing environmental protection and management.
4. Describe the socio-economic drivers of environmental degradation and inequality</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
CO1	3	3	-	-	-	-	3	3	-	-	-	-
CO2	-	3	3	3	-	-	3	3	3	2	-	-
CO3	-	2	3	3	-	-	3	3	3	3	-	-
CO4	-	2	-	-	-	-	3	3	3	3	-	-

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

Unit No.	Course Content	Hours
1	**Environmental Pollution** Definition: Causes, effects and control measures of: Air pollution, Water pollution: Causes, effects and control measures, Marine pollution, Soil pollution: Causes, effects and control measures, Noise pollution: Causes, effects and control measures, Thermal pollution: Causes, effects and control measures, Nuclear hazards and their effects. Solid waste Management: Causes, effects and control, measures of urban and Industrial wastes, Role of an individual in prevention of pollution.	07
2	**Understanding climate change and other global environmental issues** -Structure of atmosphere; greenhouse gas emissions; Projections of global climate change, Importance of 1.5 °C and 2.0 °C limits to global warming; Carbon foot print, -Impacts of climate change: on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure;-Mitigation of climate change: Green House Gas (GHG) reduction, sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policies for mitigation, net zero targets for the future; Energy efficiency measures; Renewable energy sources for carbon reduction; Carbon capture and storage, Acid Rain: Causes, effects and mitigation, Ozone Layer Depletion: Causes, effects and mitigation	08
3	**Environmental legislation** Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g), Environmental Protection Act., Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.	06
4	**Social Environment**	04

	Environmental ethics, Environmental movements- Chipko Movement, Appiko Movement, Silent Valley Movement. Water conservation: rain water harvesting, watershed management, Disaster management: floods, earthquake, cyclone, tsunami and landslides.	

Sr. No.	Text Books
1	Agarwal, K. C. 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2	Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 380013, India.
3	Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
Sr. No.	**Reference Books**
1	Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. ,2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
2	Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press.
3	Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
4	Heywood, V. H. & Watson, R. T., 1995, Global Biodiversity Assessment, Cambridge Univ. Press.
5	Jadhav, H. & Bhosale, V. M., 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi.
6	Mckinney, M. L. & Schocl. R. M. ,1996, Environmental Science Systems & Solutions, Web enhanced edition.
7	Miller T. G. Jr., Environmental Science, Wadsworth Publishing Co. (TB).
8	Odum, E. P., 1971, Fundamentals of Ecology, W. B. Saunders Co. USA.
9	Rao M. N. & Datta, A. K. ,1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd.
10	Sharma B. K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
11	Survey of the Environment, The Hindu (M).
12	Trivedi R. K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R).
13	Wagner K. D., 1998, Environmental Management, W. B. Saunders Co. Philadelphia, USA.
Sr. No.	**Important web links**
1	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
2	http://nitttrc.edu.in/nptel/courses/video/109105203/L41.html

SEM – III

Sr. No.	Second Year B. Tech Semester III Pre-revised syllabus	Second Year B. Tech Semester III Revised syllabus	Remark
1	Engineering Mathematics-III	Engineering Mathematics-III	Content is revised
2	Electronics Circuit Design-I	Electronic Circuit Design (Theory & Lab)	Clubbed in another course with content revision.
3	Digital Electronics (Theory & Lab)	Digital Electronics (Theory & Lab)	Content is revised.
4	Network Analysis	Network Analysis	Content revision
5	Programming Techniques	Programming Techniques	Content revision
7	Soft Skills Development	Soft Skills Development	Content is revised
8	Environmental Studies	Environmental Studies	No change as it is centrally offered by the University.
9	Aptitude and Professional communication	------	Shifted to next semester.

SEM – IV

Sr. No.	Second Year B. Tech Semester IV Pre-revised syllabus	Second Year B. Tech Semester IV Revised syllabus	Remark
1	Measurements & Instrumentation	Measurements & Instrumentation	Content revision.
2	----------	Signals & Systems	Shifted from next semester
3	Analog Communication	Analog & Digital Communication	Title change & Clubbed in a another course with content revision.
4	Linear Integrated Circuits	Analog Electronics	Title change & content revision.
5	Data Structures	Data Structures	Content revision.
6	---------	Multidisciplinary Minor Courses are introduced	Added as per the guidelines of NEP- 2020
7	Electronics Circuit Design -II	----------	Clubbed & shifted to previous semester
8	Electronics Circuit Design –II (Lab)	----------	Clubbed & shifted to previous semester
9	Introduction to Performing Arts	Introduction to Performing Arts	Made it as a Credit course with content revision.
11	------	Aptitude Enhancement Course I	Newly introduced.
12	Environmental Studies	Environmental Studies	Modified as per University prescribed. But there are no credits. The evaluation is at the end of Even Semester.

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, 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

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 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	
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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.