



**St. Thomas College of Engineering & Technology**

**Vellilode, Sivapuram PO. Mattanur. Kannur District, Kerala**

Approved by AICTE New Delhi, Govt. Of Kerala and Affiliated to APJ Abdul Kalam Technological University

# COURSE HANDOUT

**(B. Tech - Semester 7)**



# St. Thomas College of Engineering & Technology

Vellilode, Sivapuram PO. Mattanur. Kannur District, Kerala

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## DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

### COLLEGE VISION

To be an Institute of repute recognized for excellence in education, innovation, and social contribution.

### COLLEGE MISSION

M1: Infrastructural Relevance - Develop, maintain and manage our campus for our stakeholders.

M2: Life-Long Learning - Encourage our stakeholders to participate in lifelong learning through industry and academic interactions.

M3: Social Connect - Organize socially relevant outreach programs for the benefit of humanity.

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### DEPARTMENT VISION

To produce professionally competent, ethically sound and socially responsible Electronics and Communication Engineers.

### DEPARTMENT MISSION

M1: Provide excellent infrastructure and lab facilities for quality education.

M2: Promote industry-academic interactions to keep up with technological advancements.

M3: Develop interpersonal skills and social responsibility among students through project-based and team-based learning.



### **PROGRAM EDUCATIONAL OBJECTIVES (PEO)**

**Graduates of B. Tech ECE program after graduation will:**

**PEO1:** Exemplify technical competence in designing, analyzing, testing and fabricating electronic circuits.

**PEO2:** Acquire leadership qualities, rapport, communication skills in the organization and adapt to changing professional and societal needs.

**PEO3:** Work effectively as individuals and as team members in multidisciplinary projects

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### **PROGRAM OUTCOMES (POS)**

**Engineering Graduates will be able to:**

**PO1 Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2 Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3 Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4 Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5 Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6 The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7 Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.



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**PO8 Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9 Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10 Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11 Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12 Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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## PROGRAM SPECIFIC OUTCOMES (PSO)

**PSO1:** Define, design, implement, model, and test electronic circuits and systems that perform signal processing functions.

**PSO2:** Segregate and select appropriate technologies for implementation of a modern communication system.



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# CONTENTS

## COURSE INFORMATION SHEETS OF SEMESTER 7 COURSES

COURSE CODE	COURSE NAME
ECT 401	MICROWAVES AND ANTENNAS
ECT 413	OPTICAL FIBER COMMUNICATION
CST 445	PYTHON FOR ENGINEERS
MCN 401	INDUSTRIAL SAFETY ENGINEERING
ECL 411	ELECTROMAGNETICS LAB
ECQ 413	SEMINAR
ECD 415	PROJECT PHASE 1



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**ECT 401**

**MICROWAVES AND  
ANTENNAS**

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## COURSE INFORMATION SHEET

<b>PROGRAMME:</b> <i>ECE (UG)</i>	<b>DEGREE:</b> <b>BTECH</b>
<b>COURSE:</b> <b>MICROWAVES AND ANTENNAS</b>	<b>SEMESTER:</b> <i>S7</i> <b>L-T-P-CREDITS:</b> <b>2-1-0-3</b>
<b>COURSE CODE:</b> <b>ECT401</b> <b>REGULATION:</b> <b>2024</b>	<b>COURSE TYPE:</b> <b>CORE</b>
<b>COURSEAREA/DOMAIN</b> <b>:COMMUNICATION</b>	<b>CONTACT HOURS:</b> <b>35</b>
<b>CORRESPONDING LAB COURSE CODE</b> <b>(IF ANY):</b> <b>ECL411</b>	<b>LAB COURSE NAME:</b> <b>ELECTROMANETICS</b> <b>LAB</b>

## SYLLABUS

MODULE	DETAILS	HOURS
I	<b>Basic antenna parameters:</b> gain, directivity, beam width and effective aperture calculations, effective height, wave polarization, radiation resistance, radiation efficiency, antenna field zones. Duality and Principles of reciprocity, Helmholtz theorem (derivation required), Field, directivity and radiation resistance of a short dipole and half wave dipole (far field derivation).	7
II	<b>Broad band antenna:</b> Principle of Log periodic antenna array and design, Helical antenna: types and design. Design of Microstrip Rectangular Patchantennas and feeding methods. Principles of Horn, Parabolic dish antenna (expression for E, Hand Gain without derivation), Mobile phone antenna – Inverted F antenna.	6
III	<b>Arrays of point sources:</b> field of two isotropic point sources, principle of pattern multiplication, linear arrays of ‘n’ isotropic point sources. Array factor, Grating lobes. Design of Broadside, End fire and Dolph Chebyshev arrays. Concept of Phase array.	8
IV	<b>Microwaves:</b> Introduction, advantages, Cavity Resonators- Derivation of resonance frequency of	8

	Rectangular cavity. Single cavity klystron- Reflex Klystron Oscillators: Derivation of Power output, efficiency and admittance. Magnetron oscillators: Cylindrical magnetron, Cyclotron angular frequency, Power output and efficiency. Travelling Wave Tube: Slow wave structures, Heli TWT, Amplification process, Derivation of convection current, axial electric field, wave modes and gain.	
V	<b>Microwave Hybrid circuits:</b> Scattering parameters, Waveguide Tees- Magic tees, Hybrid rings. Formulation of S-matrix. Directional couplers: Two hole directional couplers, S-matrix. Circulators and Isolators. Phase Shifter.  Microwave Semiconductor Devices: Amplifiers using MESFET. Principle of Gunn diodes: Different modes, Principle of operation Gunn Diode Oscillators.	6
Total hours		35

### TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Balanis, Antenna Theory and Design, 3/e, Wiley Publications.
T2	John D. Krauss, Antennas for all Applications, 3/e, TMH.
T3	K D Prasad, Antenna and Wave Propagation, Satyaprakash Publications
T4	Samuel Y. Liao, Microwave Devices and Circuits, 3/e, Pearson Education, 2003.
T5	Robert E. Collin, Foundation of Microwave Engineering, 2/e, Wiley India, 2012.
R1	Collin R.E, Antennas & Radio Wave Propagation, McGraw Hill. 1985.
R2	Jordan E.C. & K. G. Balmain, Electromagnetic Waves & Radiating Systems, 2/e, PHI.



	<b>UNDERSTAND</b>												
ECT401.2	Analyze the far field pattern of Short dipole and Half wave dipole antenna.												
	3	3	3	1	2							2	2
	<b>ANALYZE</b>												
ECT401.3	Design of various broad band antennas, arrays and its radiation patterns.												
	3	3	3	1	3							2	2
	<b>APPLY</b>												
ECT401.4	Illustrate the principle of operation of cavity resonators and various microwave sources.												
	3	3	2	1								2	2
	<b>APPLY</b>												
ECT401.5	Explain various microwave hybrid circuits and microwave semiconductor devices.												
	3	3	2	1								2	2
	<b>APPLY</b>												
MAPPING AVERAGE	3	3	2.5	1.0	2.5							2.0	2.0

### JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPING LEVEL	JUSTIFICATION
ECT401.1	PO1	3	Involves fundamental engineering concepts such as radiation resistance, gain, and directivity.
	PO2	3	Requires analytical understanding of various antenna characteristics.
	PO4	1	Encourages interpretation of antenna zones and field regions through simple experiments or visualizations.
	PO12	2	Antenna knowledge is essential for lifelong learning in wireless and communication technologies.
	PSO2	2	Antenna principles are foundational for practical communication system development.
ECT401.2	PO1	3	Applies EM theory to derive far-field equations and antenna properties.
	PO2	3	Requires analysis and evaluation of radiation patterns

			and parameters.
	PO3	3	Involves design-oriented interpretation of antenna performance.
	PO4	1	Far-field analysis can include experimental verification or simulations.
	PO5	2	Involves the use of software tools to plot and interpret field patterns.
	PO12	2	Supports understanding of real-time wireless applications, fostering continued learning.
	PSO2	2	Enhances design and analysis skills in practical antenna implementations.
ECT401.3	PO1	3	Requires core engineering knowledge in antenna array theory and broadband design.
	PO2	3	Students evaluate constraints and parameters of array designs.
	PO3	3	Involves the actual design of antenna systems and radiation characteristics.
	PO4	1	Investigative aspect through array simulation or pattern evaluation.
	PO5	3	Use of modern tools (like HFSS, MATLAB) to model and design antennas.
	PO12	2	Design tasks encourage adaptability to emerging communication technologies.
	PSO2	2	Directly supports the design and deployment of antennas in real-world applications.
ECT401.4	PO1	3	Understanding of wave behavior in resonators requires strong core knowledge
	PO2	3	Analyzing microwave source behavior (e.g., Klystron, TWT) involves analytical problem-solving.
	PO3	2	Basic design understanding of cavity operation and mode analysis.
	PO4	1	May include analysis of response from resonators or wave interaction experimentally or through simulation.
	PO12	2	Supports continued learning in high-frequency device technologies.
	PSO1	2	Direct relevance to microwave component operation and

			system integration.
ECT401.5	PO1	3	Applies engineering principles to hybrid circuits (e.g., couplers, circulators).
	PO2	3	Involves analytical study of device behavior and characteristics.
	PO3	2	Includes understanding and basic design of circuit behaviors and responses.
	PO4	1	Investigating microwave device behavior and evaluating device parameters.
	PO12	2	Supports learning of new semiconductor technologies used in modern RF systems.
	PSO1	2	Enables proficiency in microwave and RF subsystem design.

**CORRELATION Levels: 3- Substantial (High) 2- Moderate (Medium) 1-Slight (Low)**

### **GAPS IN THE SYLLABUS-TO MEET INDUSTRY/PROFESSION REQUIREMENTS**

<b>SL NO:</b>	<b>DESCRIPTION</b>	<b>PROPOSED ACTIONS</b>	<b>RELEVANCE WITH POS /PSOS</b>
<b>1</b>	No topics on 5G, IoT or modern wireless antennas	Include a seminar or module on 5G/IoT antenna trends	PO1, PO12, PSO2

### **CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN**

<b>SL NO:</b>	<b>DESCRIPTION</b>	<b>PROPOSED ACTIONS</b>	<b>RELEVANCE WITH POS /PSOS</b>
<b>1</b>	Hands-on exposure to antenna design using modern simulation tools(HFSS)	Include mini-projects/workshop/ lab assignments using antenna simulation tools	PO5, PO4, PO3, PSO1, PSO2

### **WEB SOURCE REFERENCES:**

<b>SL NO:</b>	<b>DESCRIPTION</b>
<b>1</b>	<b>Analysis and Design Principles of Microwave Antennas</b> (IIT Kharagpur) — NPTEL Course page / preview: <a href="https://onlinecourses.nptel.ac.in/noc24_ee150/preview">https://onlinecourses.nptel.ac.in/noc24_ee150/preview</a> NPTEL Online Courses Archive with lecture list: <a href="https://archive.nptel.ac.in/courses/108/105/108105114/">https://archive.nptel.ac.in/courses/108/105/108105114/</a> NPTEL Online Courses

2	<b>Antennas (by Prof. Girish Kumar, IIT Bombay) — NPTEL / Swayam</b> <b>Course page / preview:</b> <a href="https://onlinecourses.nptel.ac.in/noc20_ee20/preview">https://onlinecourses.nptel.ac.in/noc20_ee20/preview</a> <b>NPTEL Online Courses</b> <b>Archive / video list:</b> <a href="https://archive.nptel.ac.in/courses/108/101/108101092/">https://archive.nptel.ac.in/courses/108/101/108101092/</a> <b>NPTEL</b>
3	<b>Basic Tools of Microwave Engineering (IIT Kharagpur) — NPTEL</b> <b>Course page / preview:</b> <a href="https://onlinecourses.nptel.ac.in/noc23_ee68/preview">https://onlinecourses.nptel.ac.in/noc23_ee68/preview</a> <b>NPTEL Online Courses</b> <b>Course page on main site:</b> <a href="https://nptel.ac.in/courses/117105122">https://nptel.ac.in/courses/117105122</a> <b>NPTEL</b>

## DELIVERY TECHNOLOGIES

<b>CLASSROOM WITH BLACK BOARD/WHITE BOARD/SMART BOARD</b>	✓	<b>ICT TOOLS</b>	
<b>CLASSROOM WITH LCD PROJECTOR</b>	✓	<b>ELECTRONIC CLASSROOM</b>	

## INSTRUCTION METHODS

<b>FACE TO FACE INSTRUCTION</b>	Direct	✓	<b>FLIPPED CLASSROOM</b>	✓
	Project-based instruction		<b>BLENDED LEARNING</b>	✓
	Problem-based instruction	✓	<b>ONLINE COURSES/MOOCs</b>	
	Technology enhanced learning	✓	<b>OTHERS (IF ANY)</b>	
	Experiential learning			
	Participative learning	✓		

## CO ASSESSMENT TOOLS-DIRECT

<b>ASSIGNMENTS</b>	✓	<b>TUTORIALS</b>	✓	<b>SERIES EXAMINATIONS</b>	✓	<b>UNIVERSITY EXAM</b>	✓
<b>LAB PRACTICES</b>		<b>VIVA</b>		<b>INTERNAL LAB EXAM</b>		<b>REPORT/ DOCUMENT PREPARATION</b>	

<b>PRESENTATION</b>		<b>EVALUATION BY GUIDE</b>		<b>INTERIM EVALUATION</b>		<b>FINAL EVALUATION</b>	
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### **CO ASSESSMENT TOOLS -INDIRECT**

<b>ASSESSMENT OF COURSE OUTCOMES (BY COURSE EXIT (END) SURVEY)</b>	✓
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### **ASSESSMENT ITEMS /CLASS SESSIONS/LAB/FIELD/TUTORIAL HOURS FOR EACH COURSE OUTCOMES**

<b>CO</b>	<b>ASSESSMENT ITEMS</b>	<b>CLASS SESSIONS</b>	<b>LAB/FIELD/TUTORIAL HOURS</b>
ECT401.1	S1,A1	12	
ECT401.2	S1,A2	8	
ECT401.3	S2,A2	10	
ECT401.4	S2,S3,A3	11	
ECT401.5	S2,S3,A3	9	
REVISION	15		
		<b>TOTAL HOURS OF INSTRUCTION</b>	65

**Prepared by  
ARSHA C DINESH**

**Approved by HOD**



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**ECT 413**

**OPTICAL FIBER  
COMMUNICATION**

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## COURSE INFORMATION SHEET

<b>PROGRAMME: ECE (UG)</b>	<b>DEGREE: BTECH</b>
<b>COURSE: OPTICAL FIBER COMMUNICATION</b>	<b>SEMESTER: S7</b> <b>L-T-P-CREDITS: 2-1-0-</b>
<b>COURSE CODE: ECT413</b> <b>REGULATION:2019</b>	<b>COURSE TYPE: ELECTIVE</b>
<b>COURSE AREA/DOMAIN:</b> COMMUNICATION	<b>CONTACT HOURS: 6 H/WEEK</b>
<b>CORRESPONDING LAB COURSE CODE</b> <b>(IF ANY):</b>	<b>LAB COURSE NAME:</b>

## SYLLABUS

MODULE	DETAILS	HOURS
I	<p><b>Optical fiber Communications:</b> The general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity</p> <p><b>Fibres:</b> Types and refractive index profiles, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fibre materials, photonic crystal fibre, index guiding PCF, photonic band-gap fibres, fibre cables.</p>	8
II	<p><b>Transmission characteristics of optical fiber:</b> Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.</p> <p><b>Optical Fiber Connectors:</b> Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers.</p>	7
III	<p><b>Optical sources:</b> LEDs and LDs, structures, characteristics, modulators using LEDs and LDs. coupling with fibres, noise in Laser diodes, Amplified Spontaneous Emission noise, effects of Laser diode noise in fibre communications</p> <p><b>Optical detectors:</b> Types and characteristics, structure and working of PIN and AP, noise in detectors, comparison of performance. Optical receivers, Ideal photo receiver and quantum limit of detection.</p>	8
IV	<p><b>Optical Amplifiers:</b> Basic concept, applications, types, doped fibre amplifiers, EDFA, basic theory, structure and working, Semiconductor laser amplifier, Raman amplifiers, TDFA, amplifier configurations, performance comparison.</p>	6

V	The WDM concept, WDM standards, WDM components, couplers, splitters, Add/ Drop multiplexers, gratings, tunable filters. Introduction to free space optics, LiFi technology and VLC. Optical Time Domain Reflectometer (OTDR) – fault detection length and refractive index measurements.	6
Total hours		35

### TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Gerd Keiser, Optical Fiber Communications, 5/e, McGraw Hill, 2013.
T2	Mishra and Ugale, Fibre optic Communication, Wiley, 2013.
R1	Chakrabarathi, Optical Fibre Communication, McGraw Hill, 2015.
R2	Hebbar, Optical fibre communication, Elsevier, 2014
R3	John M Senior- Optical communications, 3/e, Pearson, 2009.
R4	Joseph C. Palais, Fibre Optic Communications, 5/e Pearson, 2013.

### COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
ECT201	Basic concepts of Solid State Devices		S3

### COURSE OBJECTIVES:

ECT413	This course aims to introduce the concepts of light transmission through optical fibers and introduce the working of optical components.
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## COURSE OUTCOMES:

After the completion of the course, the student will be able to

COs / CO-PO/PSO MAPPING. /BLOOM'S TAXONOMY LEVEL	PO 1	PO 2	PO 3	PO 4	PO 5	P O 6	P O 7	P O 8	P	P O 10	P O 11	PO 12	PS O1	PS O2
ECT413.1	Understand the working and classification of optical fibers in terms of propagation modes													
	3	3	1									1		3
	UNDERSTAND													
ECT413.2	Solve problems of transmission characteristics and losses in optical fiber													
	3	3	2									1		3
	APPLY													
ECT413.3	Explain the constructional features and the characteristics of optical sources and detectors													
	3	3	2									1		3
	UNDERSTAND													
ECT413.4	Describe the operations of optical amplifiers													
	3	3	1									1		3
	UNDERSTAND													
ECT413.5	Understand the concept of WDM, FSO and LiFi													
	3	3	2									1		3
	UNDERSTAND													
MAPPING AVERAGE	3. 0	3. 0	1. 6									1. 0		3. 0

## JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPING LEVEL	JUSTIFICATION
ECT413.1	PO1	3	Strongly applies fundamental engineering and physics concepts to understand fiber structures and modes.
	PO2	3	Involves analyzing and interpreting fiber propagation problems, supporting high-level

			problem analysis.
	PO3	1	Slightly helps in basic design considerations of fiber links, hence mapped low.
	PO12	1	Encourages awareness of evolving fiber types, modestly supporting lifelong learning.
	PSO2	3	Directly relates to selecting suitable fiber technologies for modern communication systems.
ECT413.2	PO1	3	Strongly applies engineering and mathematical fundamentals to analyze losses and dispersion.
	PO2	3	Directly involves problem analysis of transmission impairments in optical fibers.
	PO3	2	Moderately aids in designing fiber systems considering loss and dispersion.
	PO12	1	Slightly promotes ongoing learning of new fiber loss mitigation techniques.
	PSO2	3	Strongly helps in selecting and evaluating technologies for implementing efficient communication systems.
ECT413.3	PO1	3	Strongly applies engineering knowledge to understand optoelectronic device principles.
	PO2	3	Directly involves analyzing device characteristics for communication applications.
	PO3	2	Moderately supports designing systems by selecting suitable sources and detectors.
	PO12	1	Slightly encourages keeping up with evolving optoelectronic technologies.
	PSO2	3	Strongly aids in choosing appropriate devices for implementing modern optical communication systems.
ECT413.4	PO1	3	Strongly applies core engineering and physics principles to understand amplifier mechanisms.
	PO2	3	Directly involves analyzing how amplifiers affect system performance.
	PO3	1	Slightly contributes to designing basic amplifier-

			inclusive systems.
	PO12	1	Encourages awareness of emerging optical amplification technologies.
	PSO2	3	Strongly supports selecting amplifier technologies for advanced communication systems.
ECT413.5	PO1	3	Strongly builds on core engineering principles to grasp modern multiplexing and optical wireless concepts.
	PO2	3	Directly involves analyzing advanced communication technologies and their applications.
	PO3	2	Moderately aids in designing systems using WDM, FSO, or LiFi techniques.
	PO12	1	Slightly fosters continued learning of cutting-edge optical technologies.
	PSO2	3	Strongly supports selecting and implementing these modern technologies in communication systems.

*CORRELATION Levels: 3- Substantial (High) 2- Moderate (Medium) 1-Slight (Low)*

## GAPS IN THE SYLLABUS-TO MEET INDUSTRY/PROFESSION REQUIREMENTS

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Lack of <b>practical exposure</b> to fiber components (splicing, connectors)	Conduct a <b>demonstration session</b> using available fiber kits or videos.	PO1, PO2, PO3, PO4, PO5, PO9, PO12, PSO1, PSO2

## CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Optical Time Domain Reflectometer (OTDR) Testing and Splicing Techniques	Arrange a <b>lab demonstration or industry visit</b> to a telecom exchange (BSNL, Jio, Airtel).	PO1, PO2, PO3, PO4, PO5, PO9, PO12, PSO1, PSO2

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## WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	<a href="https://onlinecourses.nptel.ac.in/noc25_ee90/announcements?force=true">https://onlinecourses.nptel.ac.in/noc25_ee90/announcements?force=true</a>

## DELIVERY TECHNOLOGIES

CLASSROOM WITH BLACK BOARD/WHITE BOARD/SMART BOARD	✓	ICT TOOLS	
CLASSROOM WITH LCD PROJECTOR	✓	ELECTRONIC CLASSROOM	

## INSTRUCTION METHODS

FACE TO FACE INSTRUCTION	Direct	✓	FLIPPED CLASSROOM	✓
	Project-based instruction		BLENDED LEARNING	✓
	Problem-based instruction	✓	ONLINE COURSES/MOOCs	
	Technology enhanced learning		OTHERS (IF ANY)	
	Experiential learning			
	Participative learning			

## CO ASSESSMENT TOOLS-DIRECT

ASSIGNMENTS	✓	TUTORIALS	✓	SERIES EXAMINATIONS	✓	UNIVERSITY EXAM	✓
LAB PRACTICES		VIVA		INTERNAL LAB EXAM		REPORT/ DOCUMENT PREPARATION	
PRESENTATION		EVALUATION BY GUIDE		INTERIM EVALUATION		FINAL EVALUATION	

## CO ASSESSMENT TOOLS -INDIRECT

ASSESSMENT OF COURSE OUTCOMES (BY COURSE EXIT (END) SURVEY)	✓
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## ASSESSMENT ITEMS /CLASS SESSIONS/LAB/FIELD/TUTORIAL HOURS FOR EACH COURSE OUTCOMES

CO	ASSESSMENT ITEMS	CLASS SESSIONS	LAB/FIELD/TUTORIAL HOURS
ECT413.1	S1,A1,T1	9	2
ECT413.2	S1,A2,T2	8	1
ECT413.3	S2,A2,T3	8	2
ECT413.4	S2,S3,A3,T4	7	1
ECT413.5	S3,A3,T5	7	1
		<b>TOTAL HOURS OF INSTRUCTION</b>	46

Prepared by Arya C

Approved by HOD



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**CST 445**

**PYTHON FOR**

**ENGINEERS**

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## COURSE INFORMATION SHEET

<b>PROGRAMME: ECE (UG)</b>	<b>DEGREE: BTECH</b>
<b>COURSE: PYTHON FOR ENGINEERS</b>	<b>SEMESTER: 7</b> <b>L-T-P-CREDITS: 2-1-0-3</b>
<b>COURSE CODE: CST445</b> <b>REGULATION: 2019</b>	<b>COURSE TYPE: ELECTIVE-OPEN</b>
<b>COURSE AREA/DOMAIN:</b> ALGORITHMS AND PROGRAMMING LANGUAGES	<b>CONTACT HOURS: 6 Hours</b>
<b>CORRESPONDING LAB COURSE CODE</b> <b>(IF ANY):</b>	<b>LAB COURSE NAME:</b>

### SYLLABUS

MODULE	DETAILS	HOURS
I	Getting Started with Python Programming - Running code in the interactive shell, Editing, Saving, and Running a script. Using editors - IDLE, Jupyter. Basic coding skills - Working with data types, Numeric data types and Character sets, Keywords, Variables and Assignment statement, Operators, Expressions, Working with numeric data, Type conversions, Comments in the program, Input Processing, and Output, Formatting output. How Python works. Detecting and correcting syntax errors. Using built in functions and modules in math module. Control statements - Selection structure - if-else, if-elif-else. Iteration structure - for, while. Testing the control statements. Lazy evaluation.	8 hours
II	Functions - Hiding redundancy and complexity, Arguments and return values, Variable scopes and parameter passing, Named arguments, Main function, Working with recursion, Lambda functions. Strings - String function. Lists - Basic list Operations and functions, List of lists, Slicing, Searching and sorting list, List comprehension. Work with tuples. Sets. Dictionaries - Dictionary functions, dictionary literals, adding and	8 hours

	removing keys, accessing and replacing values, traversing dictionaries, reverse lookup.	
III	Design with classes - Objects and Classes, Methods, Instance Variables, Constructor, Accessors and Mutators. Structuring classes with Inheritance and Polymorphism. Abstract Classes. Exceptions - Handle a single exception, Handle multiple exceptions.	6 hours
IV	Plotting - An Interactive Session with PyPlot, Basic Plotting, Logarithmic Plots, More Advanced Graphical Output, Plots with multiple axes, Mathematics and Greek symbols, The Structure of matplotlib, Contour and Vector Field Plots. File Processing - The os and sys modules, Introduction to file I/O, Reading and writing text files, Working with CSV files.	6 hours
V	Numerical Routines. SciPy and NumPy - Basics, Creating arrays, Arithmetic, Slicing, Matrix Operations, Special Functions, Random Numbers, Linear Algebra, Solving Nonlinear Equations, Numerical Integration, Solving ODEs. Data Manipulation and Analysis – Pandas: Reading Data from Files Using Pandas, Data Structures: Series and Data Frame, Extracting Information from a Data Frame, Grouping and Aggregation.	7 hours
Total hours		35 hours

### **TEXT BOOKS/REFERENCE BOOKS:**

<b>T/R</b>	<b>BOOK TITLE/AUTHORS/PUBLICATION</b>
T1	Kenneth A Lambert., Fundamentals of Python : First Programs, 2/e, Cengage Publishing, 2016
T2	David J. Pine, Introduction to Python for Science and Engineering, CRC Press, 2021
R1	Wes McKinney, Python for Data Analysis, 2/e, Shroff / O'Reilly Publishers, 2017

R2	Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2/e, Schroff, 2016
R3	Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
R4	David M.Baezly, Python Essential Reference. Addison-Wesley Professional; 4/e, 2009.
R5	Charles Severance. Python for Informatics: Exploring Information
R6	<a href="http://swcarpentry.github.io/python-novice-gapminder/">http://swcarpentry.github.io/python-novice-gapminder/</a>

### **COURSE PREREQUISITES:nil**

<b>COURS E CODE</b>	<b>COURSE NAME</b>	<b>DESCRIPTION</b>	<b>SEMESTER</b>

### **COURSE OBJECTIVES:**

<b>1</b>	The objective of the course is to provide learners an insight into Python programming in a scientific computation context and develop programming skills to solve engineering problems. It covers programming environments, important instructions, data representations, intermediate level features, Object Oriented Programming and file data processing of Python. This course lays the foundation to scientific computing, develop web applications, Machine Learning, and Artificial Intelligence-based applications and tools, Data Science and Data Visualization applications.
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### **COURSE OUTCOMES:**

**After the completion of the course, the student will be able to**

COs / CO-PO/ PSO MAPPING · /BLOOM' S TAXONO MY LEVEL	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O 7	PO 8	P	P O	P O	PO 12	PS O 1	PS O 2
											1 0	1 1		
	Write, test and debug Python programs													

CST44 5.1	3	3										2	1	1
	APPLY													
	Illustrate uses of conditional (if, if-else, if-elif-else and switch-case) and iterative (while and for) statements in Python programs													
CST44 5.2	2	3										2	1	1
	APPLY													
	Develop programs by utilizing the modules Lists, Tuples, Sets and Dictionaries in Python													
CST44 5.3	3	3										2	1	1
	APPLY													
	Implement Object Oriented programs with exception handling													
CST44 5.4	2	3	3		3							3	1	1
	APPLY													
	Analyze, Interpret, and Visualize data according to the target application													
CST44 5.5	2	3	3		3							2	2	1
	APPLY													
	Develop programs in Python to process data stored in files by utilizing the modules Numpy, Matplotlib, and Pandas													
CST44 5.6	2	3	3		2							2	2	1
	APPLY													
	MAPPI NGAVE RAGE													
	2. 3 3	3. 0 0	3. 0 0		2.67							2. 1 7	1. 3 3	1. 0 0

### JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPI NG LEVEL	JUSTIFICATION
CST445.1	PO1	3	Students apply basic programming knowledge in python
	PO2	3	Students analyze problems and write correct, bug free code
	PO12	2	Motivate for continuous learning of evolving programming language and tools

	PSO1	1	Learning python programming helps students write codes for testing signals and working with circuit data.
	PSO2	1	Students can use Python to simulate small communication processes like data transmission or signal modulation
CST445.2	PO1	2	Applying engineering knowledge in control structures and logic
	PO2	3	Analyzing problems and implementing correct control flow
	PO12	2	Prepare students for continuous learning and adaption to new languages and technologies
	PSO1	1	Students practice decision-making and looping structures in Python, useful for implementing signal flow control in electronic systems, like signal switching or sampling.
	PSO2	1	Helps to develop small Python-based models of communication protocols (for example, checking for signal errors or handling communication loops).
CST445.3	PO1	3	Builds engineering knowledge in data structures
	PO2	3	Develops problem analysis skills for data handling
	PO12	2	Encourages life-long learning of evolving data structures and technologies
	PSO1	1	Students learn how to store and process large sets of data in Python, which is important for signal data processing, filtering, and storing test results from circuits.
	PSO2	1	Useful for handling communication data like messages, packets, and channel data in communication systems by using Python data structures.
CST445.4	PO1	2	Application of core engineering programming knowledge (OOP, Exceptions)
	PO2	3	Analytical skills for class design and exception management
	PO3	3	Designing object-oriented solutions with error handling
	PO5	3	Use of modern software development tools
	PO12	3	Prepare for lifelong learning in OOP languages and tools

	PS01	1	Helps students organize Python programs into modules and handle errors, useful in building complex signal processing software tools.
	PS02	1	Supports designing robust and error-free communication software models in Python, useful for simulating communication channels.
CST445.5	PO1	2	Applying engineering knowledge in data handling and visualization
	PO2	3	Analyzing engineering data for interpretation
	PO3	3	Designing effective visualization solutions
	PO5	3	Using modern tools like Matplotlib and Seaborn
	PO12	2	Encouraging learning of new data analysis and visualization tools
	PS01	2	Students learn to analyze and plot signal data like frequency, amplitude, noise using Python tools like Matplotlib.
	PS02	1	Students can analyze and visualize the performance of communication systems, like plotting signal strength, BER (Bit Error Rate), or network load graphs.
CST445.6	PO1	2	Applying engineering knowledge in data processing and analysis
	PO2	3	Analysis and interpretation of raw file data
	PO3	2	Designing complete python programs for data analysis tasks.
	PO5	3	Using modern python libraries and data tools (NumPy, Pandas, Matplotlib)
	PO12	3	Encouraging students towards continuous learning of new tools and techniques
	PS01	2	Students use Python libraries like Numpy for numerical signal processing and Matplotlib for signal visualization, helping them in signal system testing.
	PS02	1	These Python tools help students to process large communication datasets, perform calculations, and visualize communication system parameters (like SNR,

			throughput, etc.).
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**CORRELATION Levels: 3- Substantial (High) 2- Moderate (Medium) 1-Slight (Low)**

## GAPS IN THE SYLLABUS-TO MEET INDUSTRY/PROFESSION REQUIREMENTS

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Lack of practical exposure to Python programming for solving real engineering problems. Advanced programming skills in data handling	Conduct basic python programming lab session focusing on Python syntax, conditional and looping structure, functions, file handling.	PO1, PO2, PO3, PO5, PO12, PSO1, PSO2

## CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Awareness of Python applications in industries like Data science, IOT and Web Development	Organize expert talks	PO1, PO2, PO3, PO5, PO12, PSO1, PSO2

## WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	<a href="https://www.youtube.com/watch?v=xAcTmDO6NTI">https://www.youtube.com/watch?v=xAcTmDO6NTI</a>
2	<a href="https://www.youtube.com/watch?v=c235EsGFcZs">https://www.youtube.com/watch?v=c235EsGFcZs</a>
3	<a href="http://digimat.in/nptel/courses/video/106106182/L01.html">http://digimat.in/nptel/courses/video/106106182/L01.html</a>
4	<a href="http://www.digimat.in/nptel/courses/video/106106145/L01.html">http://www.digimat.in/nptel/courses/video/106106145/L01.html</a>
5	<a href="https://www.youtube.com/watch?v=vLqTf2b6GZw">https://www.youtube.com/watch?v=vLqTf2b6GZw</a>

## DELIVERY TECHNOLOGIES

CLASSROOM WITH BLACK BOARD/WHITE BOARD/SMART BOARD		ICT TOOLS	
CLASSROOM WITH LCD PROJECTOR		ELECTRONIC CLASSROOM	

## INSTRUCTION METHODS

FACE TO FACE	Direct		FLIPPED CLASSROOM	
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<b>INSTRUCTION</b>	Project-based instruction		<b>BLENDED LEARNING</b>	
	Problem-based instruction		<b>ONLINE COURSES/MOOCs</b>	
	Technology enhanced learning		<b>OTHERS (IF ANY)</b>	
	Experiential learning			
	Participative learning			

### **CO ASSESSMENT TOOLS-DIRECT**

<b>ASSIGNMENTS</b>		<b>TUTORIALS</b>		<b>SERIES EXAMINATIONS</b>		<b>UNIVERSITY EXAM</b>	
<b>LAB PRACTICES</b>		<b>VIVA</b>		<b>INTERNAL LAB EXAM</b>		<b>REPORT/ DOCUMENT PREPARATION</b>	
<b>PRESENTATION</b>		<b>EVALUATION BY GUIDE</b>		<b>INTERIM EVALUATION</b>		<b>FINAL EVALUATION</b>	

### **CO ASSESSMENT TOOLS -INDIRECT**

<b>ASSESSMENT OF COURSE OUTCOMES (BY COURSE EXIT (END) SURVEY)</b>	
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### **ASSESSMENT ITEMS /CLASS SESSIONS/LAB/FIELD/TUTORIAL HOURS FOR EACH COURSE OUTCOMES**

<b>CO</b>	<b>ASSESSMENT ITEMS</b>	<b>CLASS SESSIONS</b>	<b>LAB/FIELD/TUTORIAL HOURS</b>
CST445.1	S1, T1	9	1 T
CST445.2	S1,A1,T2	4	1 T
CST445.3	S1,A2,T3	12	1 T
CST445.4	S2,A2,T4	12	1 T
CST445.5	S2,S3, A3,T5	6	1 T
CST445.6	S3,A3,T6	15	1 T

	<b>TOTAL HOURS OF INSTRUCTION</b>	64
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**Prepared by NAVYA N C**

**Approved by HOD**



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**MCN 401**

**INDUSTRIAL**

**SAFETY**

**ENGINEERING**

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**COURSE INFORMATION SHEET**

<b>PROGRAMME: ECE (UG)</b>	<b>DEGREE: BTECH</b>
<b>COURSE: INDUSTRIAL SAFETY ENGINEERING</b>	<b>SEMESTER: L-T-P-CREDITS: 2-1-0-NIL</b>
<b>COURSE CODE: MCN401 REGULATION: 2019 SCHEME</b>	<b>COURSE TYPE: NON-CORE</b>
<b>COURSE AREA/DOMAIN: INDUSTRIAL SAFETY</b>	<b>CONTACT HOURS: 5</b>
<b>CORRESPONDING LAB COURSE CODE (IF ANY): NIL</b>	<b>LAB COURSE NAME: NIL</b>

## SYLLABUS

MODULE	DETAILS	HOURS
I	Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.	5
II	Personal protection in the work environment, Types of PPEs, Personal protective equipment respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.	7
III	Introduction to construction industry and safety issues in construction Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning & Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Confined space – Temporary Structures. Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety. Relevance of ergonomics in construction safety. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.	7
IV	Machinery safeguard-Point-of-Operation, Principle of machine guarding -types of guards and devices. Safety in turning, and grinding.	8

	Welding and Cutting-Safety Precautions of Gas welding and Arc Welding. Material Handling-Classification-safety consideration-manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment-operation & maintenance. Maintenance of common elements-wire rope, chains slings, hooks, clamps. Hearing Conservation Program in Production industries.	
V	Hazard and risk, Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion hazard rating of process plants - The Dow Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard and Operability study (HAZOP)) – methodology, criticality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardous properties of chemicals, Material Safety Data Sheets (MSDS).	8
Total hours		35

### TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
T2	Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.
R1	Krishnan, N.V. (1997). Safety management in Industry. Jaico Publishing House, New Delhi.
R2	John V. Grimaldi and Rollin H.Simonds. (1989) Safety management. All India Traveller Book Seller, Delhi.
R3	Ronald P. Blake. (1973). Industrial safety. Prentice Hall, New Delhi.
R4	Alan Waring. (1996). Safety management system. Chapman & Hall, England.
R5	Vaid, K.N., (1988). Construction safety management. National Institute of Construction Management and Research, Mumbai.
R6	AICHe/CCPS. (1992). Guidelines for Hazard Evaluation Procedures. (second edition). Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York.

## COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
NIL			

## COURSE OBJECTIVES:

1	The course is intended to give knowledge of various safety management principles, various safety systems, various machine guarding devices, hazard identification techniques, energy sources, systems & applications and the need in the present context. Learners will be able to compare different hazard identification tools and choose the most appropriate based on the nature of industry. It aims to equip students in working with projects and to take up research work in connected areas
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## COURSE OUTCOMES:

**After the completion of the course, the student will be able to**

COs / CO-PO/PSO MAPPING. /BLOOM'S TAXONOMY LEVEL	P O  1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	P O  8	P O  9	P O 1 0	P O  1 1	P O  1 2	P S O  1	P S O  2
MCN401.1	Describe the theories of accident causation and preventive measures of industrial accidents.													
	2	2				2	2	2					1	2
<b>UNDERSTAND</b>														
MCN401.2	Explain about personal protective equipment, its selection, safety performance & indicators and importance of housekeeping.													
	2	1	2		1	1	1	1					1	2
<b>UNDERSTAND</b>														
MCN401.3	Explain different issues in construction industries.													
	2	2	2		1	1	1	1	1	1			1	2
<b>UNDERSTAND</b>														
MCN401.4	Describe various hazards associated with different machines and mechanical material handling.													
	2	2	2		1	1	1	1	1	1			1	2
<b>UNDERSTAND</b>														
MCN401.5	Utilise different hazard identification tools in different industries with the knowledge of different types of chemical hazards.													
	2	2	2	1	1	1	1	1	1	1			1	2

	<b>APPLY</b>													
MAPPING AVERAGE	2.00	1.80	2.00	1.00	1.00	1.20	1.20	1.20	1.00	1.00		1.00	2.00	2.00

### JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
MCN401.1	PO1	2	Understanding theories requires application of engineering fundamentals.
	PO2	2	Analyzing causes of accidents involves identifying and formulating complex problems.
	PO6	2	Safety is a societal issue; assessing societal and health implications is essential.
	PO7	2	Preventing accidents aligns with sustainable engineering practices.
	PO8	2	Ethical responsibility is key in safety practices.
	PO12	1	Continuous learning is needed due to evolving safety regulations.
	PSO1	2	Domain-specific knowledge in industrial safety and regulatory compliance is applied.
	PSO2	2	Domain-specific knowledge in industrial safety and regulatory compliance is applied.
MCN401.2	PO1	2	Requires understanding scientific principles behind PPE.
	PO2	1	Involves problem analysis for selecting appropriate equipment.
	PO3	2	Designing or recommending safety systems is part of development solutions.
	PO5	1	Selection may involve simulation tools or standards.
	PO6	1	PPE addresses health and safety concerns.
	PO7	1	Promotes safe and sustainable working environments.
	PO8	1	Ensures compliance with ethical and legal standards.
	PO12	1	Continuous learning is needed due to evolving safety regulations.
	PSO1	2	Involves specific skills in equipment selection and safety assessment.
	PSO2	2	Involves specific skills in equipment selection and

			safety assessment.
MCN401.3	PO1	2	Requires knowledge of engineering practices in construction.
	PO2	2	Identifying hazards is a form of problem analysis.
	PO3	2	Addresses need for safe system/process design.
	PO5	1	Analysis may include using modern tools
	PO6	1	Safety in construction has significant societal/legal implications.
	PO7	1	Sustainable construction practices are addressed.
	PO8	1	Ethical handling of worker safety is critical.
	PO9	1	Requires collaboration among multidisciplinary teams.
	PO10	1	Communication is essential for site safety instructions.
	PO12	1	Construction practices evolve, demanding lifelong learning.
	PSO1	2	Application of industrial safety principles in the construction domain.
	PSO2	2	Application of industrial safety principles in the construction domain.
MCN401.4	PO1	2	Involves knowledge of machines and materials.
	PO2	2	Analyzing mechanical hazards is a key part of problem analysis.
	PO3	2	Safety designs for machines/material handling systems.
	PO5	1	Modern tools may be used for analysis (e.g., risk assessment software).
	PO6	1	Addresses safety and legal issues in machinery usage.
	PO7	1	Promotes environmentally safe material handling.
	PO8	1	Addresses ethical responsibilities related to machine safety.
	PO9	1	Team coordination and communication are vital in handling systems.
	PO10	1	Team coordination and communication are vital in handling systems.
	PO12	1	Lifelong learning ensures adaptation to changing technology

	PSO1	2	Domain-specific safety knowledge in mechanical operations.
	PSO2	2	Domain-specific safety knowledge in mechanical operations.
MCN401.5	PO1	2	Requires foundational knowledge of chemicals and processes.
	PO2	2	Identifying chemical hazards involves complex problem analysis.
	PO3	2	Designing hazard control measures fits under solution development.
	PO4	1	Involves experimental methods and data analysis for hazard identification.
	PO5	1	Use of tools like HAZOP, FMEA, etc. is part of modern tool usage.
	PO6	1	Chemical safety is a major societal and legal concern.
	PO7	1	Aligns with sustainable and eco-friendly practices.
	PO8	1	Handling hazardous materials requires ethical compliance.
	PO9	1	Team-based safety audits and reporting are involved.
	PO10	1	Team-based safety audits and reporting are involved.
	PO12	1	Safety standards evolve—lifelong learning is crucial.
	PSO1	2	Core to industrial safety and chemical hazard management.
	PSO2	2	Core to industrial safety and chemical hazard management.

**CORRELATION Levels: 3- Substantial (High) 2- Moderate (Medium) 1-Slight (Low)**

## **GAPS IN THE SYLLABUS-TO MEET INDUSTRY/PROFESSION REQUIREMENTS**

<b>SL NO:</b>	<b>DESCRIPTION</b>	<b>PROPOSED ACTIONS</b>	<b>RELEVANCE WITH POS /PSOS</b>
<b>1</b>	Practical exposure to fire safety equipment, including types, operation, and real-time handling of fire extinguishers.	An industrial interaction / hands-on understanding of different fire extinguishers and their usage .	PO1,PO3,PO5,PO6, PO7,PO8,PSO1,PSO 3

## CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS

## WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	<a href="https://onlinecourses.nptel.ac.in/noc20_mg43/preview">https://onlinecourses.nptel.ac.in/noc20_mg43/preview</a>
2	<a href="https://archive.nptel.ac.in/courses/110/105/110105094/">https://archive.nptel.ac.in/courses/110/105/110105094/</a>

## DELIVERY TECHNOLOGIES

CLASSROOM WITH BLACK BOARD/WHITE BOARD/SMART BOARD		ICT TOOLS	
CLASSROOM WITH LCD PROJECTOR		ELECTRONIC CLASSROOM	

## INSTRUCTION METHODS

FACE TO FACE INSTRUCTION	Direct		FLIPPED CLASSROOM	
	Project-based instruction		BLENDED LEARNING	
	Problem-based instruction		ONLINE COURSES/MOOCs	
	Technology enhanced learning		OTHERS (IF ANY)	
	Experiential learning			
	Participative learning			

## CO ASSESSMENT TOOLS-DIRECT

ASSIGNMENTS		TUTORIALS		SERIES EXAMINATIONS		UNIVERSITY EXAM	
LAB PRACTICES		VIVA		INTERNAL LAB EXAM		REPORT/ DOCUMENT PREPARATION	
PRESENTATION		EVALUATION BY GUIDE		INTERIM EVALUATION		FINAL EVALUATION	

## CO ASSESSMENT TOOLS -INDIRECT

ASSESSMENT OF COURSE OUTCOMES (BY COURSE EXIT (END) SURVEY)	
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## ASSESSMENT ITEMS /CLASS SESSIONS/LAB/FIELD/TUTORIAL HOURS FOR EACH COURSE OUTCOMES

CO	ASSESSMENT ITEMS	CLASS SESSIONS	LAB/FIELD/TUTORIAL HOURS
MCN401.1	S1,A1,T1	6 HOURS	1 HOURS
MCN401.2	S1,A2,T2	8 HOURS	1 HOURS
MCN401.3	S2,A2,T3	9 HOURS	1 HOURS
MCN401.4	S2,S3,A3,T4	10 HOURS	1 HOURS
MCN401.5	S3,A3,T5	9 HOURS	1 HOURS
		<b>TOTAL HOURS OF INSTRUCTION</b>	47

Prepared by Athira V

Approved by HOD



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**ECL 411**

**ELECTROMAGNETICS**

**LAB**

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## COURSE INFORMATION SHEET

<b>PROGRAMME: ECE (UG)</b>	<b>DEGREE: BTECH</b>
<b>COURSE: ELECTROMAGNETICS LAB</b>	<b>SEMESTER: L-T-P-CREDITS: 0-0-3-2</b>
<b>COURSE CODE: ECL411 REGULATION:</b>	<b>COURSE TYPE: CORE</b>
<b>COURSE AREA/DOMAIN: COMMUNICATION</b>	<b>CONTACT HOURS: 6</b>
<b>CORRESPONDING LAB COURSE CODE (IF ANY):</b>	<b>LAB COURSE NAME:</b>

## **SYLLABUS**

MODULE	DETAILS	HOURS
I	<p>I. MICROWAVE EXPERIMENTS (Minimum Four Experiments are mandatory)</p> <ol style="list-style-type: none"> <li>1. Reflex Klystron Mode Characteristics.</li> <li>2. GUNN diode characteristics.</li> <li>3. VSWR and Frequency measurement.</li> <li>4. Verify the relation between Guide wave length, free space wave length and cut off wave length for rectangular wave guide.</li> <li>5. Unknown load impedance measurement using smith chart and verification using transmission line equation.</li> <li>6. Measurement of Magic Tee characteristics.</li> <li>7. Directional Coupler Characteristics.</li> <li>8. Crystal Index Measurement.</li> </ol>	12
II	<p>II. OPTICAL EXPERIMENTS (Minimum Three Experiments are mandatory)</p> <ol style="list-style-type: none"> <li>1. Setting up of Fiber optic Digital link.</li> <li>2. Measurement of Numerical Aperture of a fiber.</li> <li>3. Study of losses in Optical fiber.</li> <li>4. Voltage vs. Current (V-I) characteristics of Laser Diode.</li> <li>5. Voltage vs. Current (V-I) characteristics of LED.</li> <li>6. Characteristics of Photodiode</li> </ol>	9

III	III. ANTENNA EXPERIMENTS (Minimum Three Experiments are mandatory) <ol style="list-style-type: none"> <li>1. Familiarization of any antenna simulation software.</li> <li>2. Simulation of Dipole Antenna.</li> <li>3. Simulation of Patch Antenna.</li> <li>4. Simulation of Antenna Array.</li> <li>5. Study of Vector Network Analyzer.</li> <li>6. Antenna Pattern Measurement</li> </ol>	9
Total hours		

**TEXT BOOKS/REFERENCE BOOKS:**

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Samuel Y. Liao, Microwave Devices and Circuits, 3/e, Pearson Education, 2003.
T2	Gred Keiser Optical Fiber Communication 5/e Mc Graw Hill, 2013
T3	Balanis, Antenna Theory and Design, 3/e, Wiley Publications.
R1	John D. Krauss, Antennas for all Applications, 3/e, TMH.
R2	Thomas A. Milligan, Modern Antenna Design, IEEE PRESS, 2/e, Wiley Inter science.
R3	N.O. Sadiku and S.V. Kulkarni, Principles of Electromagnetics, Sixth Edition, Oxford University Press, India, 2015 (Asian adaptation of 'M.N.O. Sadiku, Elements of Electromagnetics, Sixth International Edition, Oxford University Press')

**COURSE PREREQUISITES: NIL**

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER

**COURSE OBJECTIVES:**

1	Provide practical experience in design and analysis of few electronic devices and circuits used for Microwave and Optical communication engineering.
2	Familiarize students with simulation of basic Antenna experiments with simulation tools.

## COURSE OUTCOMES:

After the completion of the course, the student will be able to

COs / CO-PO/PSO MAPPING. /BLOOM'S TAXONOMY LEVEL	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
ECL411.1	Familiarize the basic Microwave components and to analyse few microwave measurements and its parameters.													
	3	3	3						3			3		3
	<b>APPLY</b>													
ECL411.2	Understand the principles of fiber-optic communications and the different kind of losses, signal distortion and other signal degradation factors.													
	3	3	3						3			3	3	3
	<b>APPLY</b>													
ECL411.3	Design and simulate basic antenna experiments with simulation tools.													
	3	3	3	2	3				3			3		3
	<b>APPLY</b>													
MAPPING AVERAGE	3	3	3	2	3				3			3	3	3

## JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
ECT201.1	PO1	3	Understanding microwave components and measurements requires application of engineering principles in electromagnetic theory and RF design.
	PO2	3	Analysis of microwave parameters like VSWR and impedance involves identifying and solving related problems using scientific principles.
	PO3	3	Exposure to component-level functions (e.g., directional couplers) fosters the ability to design

			sub-systems and measurement setups.
	PO9	2	Lab activities and measurements in microwave engineering require teamwork and collaboration in group experiments.
	PO12	3	Learners are introduced to advanced communication domains, motivating further independent and lifelong learning.
	PSO2	3	Microwave is foundational to modern wireless communication systems (radar, satellite, 5G), helping students select appropriate technologies.
ECT201.2	PO1	3	Application of physics (optics) and communication principles to understand fiber-optic signal transmission.
	PO2	3	Losses and signal distortion analysis involves problem identification and solution using core science fundamentals.
	PO3	3	Understanding degradation mechanisms is essential for developing optical link budgets and solutions.
	PO9	3	Students work in teams to evaluate losses and dispersion using lab tools.
	PO12	3	Optical communication is a rapidly evolving field that promotes curiosity and continuous learning.
	PSO1	3	Learning optical transmission supports signal processing across various modulation formats.
	PSO2	3	Core technology for modern broadband and long-distance communication, supporting system-level technology choices.
ECT201.3	PO1	3	Antenna design is grounded in electromagnetic theory and engineering fundamentals.
	PO2	3	Analysis of radiation patterns and gain involves solving electromagnetic field problems.
	PO3	3	Antenna simulation and design directly relate to solving complex design tasks.
	PO4	2	Interpretation of simulation results and parametric

			study enhances investigative abilities.
	PO5	3	Use of modern tools like HFSS/CST for modeling antennas aligns with tool proficiency outcomes.
	PO9	3	Antenna design projects often involve team-based simulations and presentations.
	PO12	3	Exposure to advanced RF simulation tools fosters self-motivated learning in emerging technologies.
	PSO2	3	Antennas are key enablers of communication systems, supporting technology evaluation and system integration.

**CORRELATION Levels: 3- Substantial (High) 2- Moderate (Medium) 1-Slight (Low)**

### **GAPS IN THE SYLLABUS-TO MEET INDUSTRY/PROFESSION REQUIREMENTS**

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1			

### **CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN**

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	To Enhances skills in simulating dipole and patch antennas, aiding RF design, analysis, and communication system development.	Workshop on Simulation of Dipole Antenna and Patch Antenna	PO1, PO2, PO3, PO4, PO5, PO6.,PSO 2

### **WEB SOURCE REFERENCES:**

SL NO:	DESCRIPTION
1	<a href="https://www.youtube.com/watch?">https://www.youtube.com/watch?</a>

**DELIVERY TECHNOLOGIES**

<b>CLASSROOM WITH BLACK BOARD/WHITE BOARD/SMART BOARD</b>	✓	<b>ICT TOOLS</b>	✓
<b>CLASSROOM WITH LCD PROJECTOR</b>		<b>ELECTRONIC CLASSROOM</b>	

**INSTRUCTION METHODS**

<b>FACE TO FACE INSTRUCTION</b>	Direct	✓	<b>FLIPPED CLASSROOM</b>	
	Project-based instruction		<b>BLENDED LEARNING</b>	
	Problem-based instruction		<b>ONLINE COURSES/MOOCs</b>	
	Technology enhanced learning		<b>OTHERS (IF ANY)</b>	
	Experiential learning	✓		
	Participative learning			

**CO ASSESSMENT TOOLS-DIRECT**

<b>ASSIGNMENTS</b>		<b>TUTORIALS</b>		<b>SERIES EXAMINATIONS</b>		<b>UNIVERSITY EXAM</b>	
<b>LAB PRACTICES</b>	✓	<b>VIVA</b>	✓	<b>INTERNAL LAB EXAM</b>	✓	<b>REPORT/ DOCUMENT PREPARATION</b>	✓
<b>PRESENTATION</b>		<b>EVALUATION BY GUIDE</b>		<b>INTERIM EVALUATION</b>		<b>FINAL EVALUATION</b>	

**CO ASSESSMENT TOOLS -INDIRECT**

<b>ASSESSMENT OF COURSE OUTCOMES (BY COURSE EXIT (END) SURVEY)</b>	✓
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**ASSESSMENT ITEMS /CLASS SESSIONS/LAB/FIELD/TUTORIAL HOURS FOR EACH COURSE OUTCOMES**

<b>CO</b>	<b>ASSESSMENT ITEMS</b>	<b>CLASS SESSIONS</b>	<b>LAB/FIELD/TUTORIAL HOURS</b>
ECL411.1	CE, IE		12
ECL411.2	CE, IE		9
ECL411.3	CE, IE		9
		<b>TOTAL HOURS OF INSTRUCTION</b>	30

**Prepared by  
Manu Thomas**

**Approved by HOD**



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**ECQ 413**  
**SEMINAR**

## COURSE INFORMATION SHEET

<b>PROGRAMME:</b> ECE(UG)	<b>DEGREE:</b> BTECH
<b>COURSE:</b> SEMINAR	<b>SEMESTER:</b> VII <b>L-T-P-CREDITS:</b> 0-0-3-2
<b>COURSE CODE:</b> ECQ413 <b>REGULATION:</b> 2019 SCHEME	<b>COURSE TYPE:</b> CORE
<b>COURSE AREA/DOMAIN:</b> ELECTRONICS AND COMMUNICATION ENGINEERING	<b>CONTACT HOUR:</b> 6Periods/week
<b>CORRESPONDING LAB COURSE CODE (IF ANY):</b> NIL	<b>LAB COURSE NAME:</b> NIL

### SYLLABUS

The topic for a UG seminar should be current and broad based rather than a very specific research work. It's advisable to choose a topic for the Seminar to be closely linked to the final year project area. Every member of the project team could choose or be assigned Seminar topics that covers various aspects linked to the Project area.

## PREAMBLE

DETAILS	HOURS
Preamble: The course ‘Seminar’ is intended to enable a B.Tech graduate to read, understand, present and prepare reports about an academic document. The learner shall search in the literature including peer reviewed journals, conference, books, project reports etc., and identify an appropriate paper/thesis/report in her/his area of interest, in consultation with her/his seminar guide. This course can help the learner to experience how a presentation can be made about a selected academic document and also empower her/him to prepare a technical report.	3 hours/week
Total hours	<b>30</b>

## COURSE OBJECTIVES:

1	To do literature survey in a selected area of study
2	To understand an academic document from the literature and to give a presentation about it.
3	To prepare a technical report.

## COURSE OUTCOMES:

After the completion of the course, the student will be able to

COs/ CO-PO/PSOMAPPING. /BLOOM'S TAXONOMY LEVEL	PO1	PO2	P	P	P	P	P	PO8	PO9	PO10	PO11	PO12	P	P	P
ECQ413.1	Identify academic documents from the literature which are related to her/his areas of interest.														
	2	2	1	1		2	1						3		
	<b>Apply</b>														

ECQ413.2	Read and apprehend an academic document from the literature which is related to her/ his areas of interest.													
	3	3	2	3		2	1					3		2
	<b>Analyze</b>													
ECQ413.3	Prepare a presentation about an academic document													
	3	2			3			1		2		3	2	2
	<b>Create</b>													
ECQ413.4	Give a presentation about an academic document.													
	3				2			1		3		3	2	3
	<b>Apply</b>													
ECQ413.5	Prepare a technical report.													
	3	3	3	3	2	2		2		3		3	2	3
	<b>Create</b>													
MAPPING AVERAGE	2.8	2.5	2.0	2.33	2.33	2.0	1.0	1.33		2.67		3.0	2	2.5

### JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PS O	MAPPING LEVEL	JUSTIFICATION
ECQ413.1	PO1	2	Ability to identify academic literature requires application of engineering knowledge
	PO2	2	Understanding of academic content reflects problem analysis skills

	PO3	1	Literature identification involves the application of solution finding strategies
	PO4	1	Require foundational engineering knowledge to identify academic content relevant to the discipline

	PO6	2	Applies reasoning and contextual knowledge to identify relevant academic content
	PO7	1	Understanding of societal context in selecting relevant research
	PO12	3	Encourages life long learning through identifying relevant resources.
ECQ413.2	PO1	3	Requires applying basic engineering knowledge to comprehend technical literature.
	PO2	3	Analytical skills are essential to interpret academic documents
	PO3	2	Critical thinking is used to break down information and draw conclusions.
	PO4	3	Require foundational engineering knowledge to understand academic content relevant to the discipline.
	PO6	2	Contextual understanding in interpreting documents.
	PO7	1	Understanding broader impacts of literature.

	PO12	3	Promotes lifelong learning through engagement with scholarly content.
	PSO2	2	Enhance preparation of Academic document with respect to the selected engineering discipline
ECQ413.3	PO1	3	Engineering knowledge applied in preparing a structured academic presentation.
	PO2	2	Understanding and interpreting information for effective presentation.
	PO5	3	Use of digital tools for presentation preparation.
	PO8	1	Use ethical academic writing, like avoiding plagiarism, properly referencing sources, and professional documentation.
	PO10	2	Directly focus on oral communication (documentation) essential to every engineer.
	PO12	3	Encourages continuous improvement in technical communication
	PSO1	2	Apply fundamental concepts of electronics and communication engineering to analyze and present technical/academic topics relevant to the discipline
	PSO2	2	Utilize modern engineering tools and techniques in electronics and communication for effective preparation and delivery of technical presentations.
ECQ413.4	PO1	3	Requires applied knowledge for oral delivery of academic content.

	PO5	2	Use digital tools (e.g., databases, citation tools, PowerPoint, document processors) in presentation and reporting.
	PO8	1	Emphasizes ethical academic writing, like avoiding plagiarism, properly referencing sources, and professional documentation.

	PO10	3	Focus on communication on oral(presentation) essential to every engineer.
	PO12	3	Promotes continual learning and professional development.
	PSO1	1	Presentation of academic document helpful to find solutions to complex real life problems
	PSO2		Demonstrates the ability to use modern presentation and communication tools effectively to convey academic and technical content in the field of electronics and communication.
ECQ413.5	PO1	3	Engineering fundamentals used in compiling technical content.
	PO2	3	Deep understanding and interpretation required for writing reports.
	PO3	3	Critical thinking needed to structure and synthesize information.
	PO4	3	Addresses real-world problems through technical documentation.
	PO5	2	Uses tools and formats for formal reporting.

	PO6	2	Shows contextual knowledge in formulating technical documents.
	PO8	2	Considers ethics in plagiarism-free technical reporting.
	PO10	3	Technical reporting is a key communication skill.
	PO12	3	Promotes independent learning through technical writing.

	PSO1	2	Preparation of academic document in relevance to solutions to complex problems in Civil Engineering
	PSO2	3	Enhance preparation of technical report in relation to the selected engineering discipline

**CORRELATION** Levels: 3-Substantial(High) 2-Moderate(Medium) 1-Slight(Low)

## COASSESSMENT TOOLS-DIRECT

ASSIGNMENTS		TUTORIALS		SERIES EXAMINATIONS		UNIVERSITY EXAM	
LAB PRACTICES		VIVA		INTERNAL LAB EXAM		REPORT/ DOCUMENT PREPARATION	
PRESENTATION		EVALUATION BY GUIDE		INTERIM EVALUATION		FINAL EVALUATION	

## COASSESSMENTTOOLS-INDIRECT

<b>ASSESSMENTOFCOURSE OUTCOMES(BYCOURSEEXIT(END)SURVEY)</b>	
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**ASSESSMENT ITEMS/CLASSESSIONS/LAB/FIELD/TUTORIAL HOURS  
FOR EACH COURSE OUTCOME**

<b>CO</b>	<b>ASSESSMENT ITEMS</b>
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<b>ECQ 413.1</b>	<b>SEMINAR DIARY,GUIDE EVALUATION,PRESENTATION</b>
<b>ECQ 413.2</b>	<b>SEMINAR DIARY,GUIDE EVALUATION,PRESENTATION</b>
<b>ECQ 413.3</b>	<b>PRESENTATION</b>
<b>ECQ 413.4</b>	<b>PRESENTATION</b>
<b>ECQ 413.5</b>	<b>REPORT</b>
<b>TOTAL HOURS OF INSTRUCTION</b>	<b>30</b>

**Prepared by**

**ARSHA C DINESH**

**Approved by HOD**



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**ECD 415**

**PROJECT PHASE 1**

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## COURSE INFORMATION SHEET

<b>PROGRAMME:</b> ECE (UG)	<b>DEGREE:</b> BTECH
<b>COURSE:</b> PROJECT PHASE 1	<b>SEMESTER:</b> S7 <b>L-T-P-CREDITS:</b> 0:0:6:2
<b>COURSE CODE:</b> ECD 415 <b>REGULATION:</b> 2019	<b>COURSE TYPE:</b> PROJECT
<b>COURSE AREA/DOMAIN:</b> ELECTRONICS AND COMMUNICATION ENGINEERING	<b>CONTACT HOURS:</b> 6 PERIODS/WEEK
<b>CORRESPONDING LAB COURSE CODE (IF ANY):</b> NIL	<b>LAB COURSE NAME:</b> NIL

### **PREAMBLE**

DETAILS	HOURS
Preamble: The course 'Project Work' is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8 <sup>th</sup> semester.	6 hours/week
Total hours	<b>66</b>

### **COURSE OBJECTIVES:**

<b>1</b>	To apply engineering knowledge in practical problem solving.
<b>2</b>	To foster innovation in design of products, processes or systems.
<b>3</b>	To develop creative thinking in finding viable solutions to engineering problems.

## COURSE OUTCOMES:

After the completion of the course, the student will be able to

COs / CO-PO/PSO MAPPING. /BLOOM'S TAXONOMY LEVEL	P O  1	PO 2	PO 3	PO 4	PO 5	PO 6	P O  7	P O  8	P O  9	P O  10	P O  11	P O  12	P S O  1	PS O2
ECD415.1	Model and solve real world problems by applying knowledge across domains													
	2	2	2	1	2	2	2	1	1	1	1	2	3	3
	<b>APPLY</b>													
ECD415.2	Develop products, processes or technologies for sustainable and socially relevant applications													
	2	2	2		1	3	3	1	1		1	1	3	3
	<b>APPLY</b>													
ECD415.3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks													
									3	2	2	1	3	3
	<b>APPLY</b>													
ECD415.4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms													
					2			3	2	2	3	2	3	3
	<b>APPLY</b>													
ECD415.5	Identify technology/research gaps and propose innovative/creative solutions													
	2	3	3	1	2							1	3	3
	<b>ANALYSE</b>													
ECD415.6	Organize and communicate technical and scientific findings effectively in written and oral forms													
					2			2	2	3	1	1	3	3
	<b>APPLY</b>													
<b>MAPPING AVERAGE</b>	2	2. 3	2. 3	1. 0	1. 8	2. 5	2 · 5	1 · 8	1. 8	2 · 0	1 · 6	1 · 3	3 · 0	3. 0

## JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPING LEVEL	JUSTIFICATION
ECD415.1	PO1	2	As students will acquire fundamental engineering knowledge across various domains.
	PO2	2	Involves analysing real-world problems while doing literature survey
	PO3	2	Involves designing practical and functional solutions for the analysed problems
	PO4	1	Slightly mapped as basic investigation or simulation may be included.
	PO5	2	Moderately mapped as appropriate tools may be used to model and solve problems.
	PO6	2	Students might consider social impact of real-world issues.
	PO7	2	While developing ideas environmental aspects may be considered
	PO8	1	Ethical implications are considered minimally.
	PO9	1	Some individual or teamwork may be involved.
	PO10	1	Students will be able to communicate their work in reviews and paper presentations
	PO11	1	Students will be able to manage the financial constraints
	PO12	2	Students will be able to apply the analysing skills in their professional career.
	PSO1	3	Strongly supports modelling and implementation.
ECD415.2	PO1	2	As the students will be able to develop new solutions.
	PO2	2	As the students will be able to perform problem analysis to build meaningful products.
	PO3	2	As the students will be able to design systems/products.
	PO5	1	As students will be able to use modern tools for

			the development of systems/products
	PO6	3	As the students will be able to address socially relevant problems directly.
	PO7	3	As the students will be able to consider sustainability as a core focus area
	PO8	1	Ethical considerations may be minimal.
	PO9	1	Product development may involve team effort.
	PO11	1	Project planning and execution may be included.
	PO12	1	Learning new tools/methods may be required.
	PSO1	3	Strong link to circuit/system design and development.
	PSO2	3	Related to applying proper technologies in real applications.
ECD415.3	PO9	3	Directly focused on teamwork and leadership.
	PO10	2	Team success depends on clear communication.
	PO11	2	Requires planning, coordination, and delegation.
	PO12	1	Involves some amount of self-directed learning.
	PSO1	3	Team contributions help achieve technical goals.
	PSO2	3	Supports working collaboratively on system development.
ECD415.4	PO5	2	Efficient use of resources often involves software tools.
	PO8	3	Ethics and professionalism are explicitly involved.
	PO9	2	Task execution involves coordination in teams.
	PO10	2	Clear communication needed during task execution.
	PO11	3	Strong focus on project and time management.
	PO12	2	Involves learning to plan and execute real tasks.
	PSO1	3	Execution of projects supports system testing/development.
	PSO2	3	Effective planning helps in successful tech

			deployment.
ECD415.5	PO1	2	Understanding fundamentals is needed to identify gaps
	PO2	3	In-depth analysis required for innovation
	PO3	3	Strong focus on proposing new designs
	PO4	1	May involve basic research or experimentation
	PO5	2	Technology tools may aid in proposing solutions
	PO11	1	Minimal project management involved
	PSO1	3	Encourages designing advanced circuits/systems
	PSO2	3	Leads to identifying new technologies for communication
ECD415.6	PO5	2	Use of documentation or software tools may be involved
	PO8	2	Communication requires professional and ethical clarity
	PO9	2	Involves teamwork-related documentation or presentations
	PO10	3	Core focus on clear oral and written communication
	PO11	1	Some planning and coordination may be involved
	PO12	1	Enhances learning via communication practices
	PSO1	3	As the students will be able to present design/test findings
	PSO2	3	As the students will be able to explain communication system proposals

***CORRELATION Levels: 3- Substantial (High) 2- Moderate (Medium) 1-Slight (Low)***

### CO ASSESSMENT TOOLS-DIRECT

ASSIGNMENTS		TUTORIALS		SERIES EXAMINATIONS		UNIVERSITY EXAM	
LAB PRACTICES		VIVA		INTERNAL LAB EXAM		REPORT/ DOCUMENT PREPARATION	✓
PRESENTATION	✓	EVALUATION BY GUIDE	✓	INTERIM EVALUATION	✓	FINAL EVALUATION	✓

### CO ASSESSMENT TOOLS -INDIRECT

ASSESSMENT OF COURSE OUTCOMES (BY COURSE EXIT (END) SURVEY)	✓
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### ASSESSMENT ITEMS /CLASS SESSIONS/LAB/FIELD/TUTORIAL HOURS FOR EACH COURSE OUTCOMES

CO	ASSESSMENT ITEMS
ECD415.1	IE,FE,GUIDE
ECD415.2 3	GUIDE
ECD415.3	FE,GUIDE
ECD415.4	IE
ECD415.5	GUIDE
ECD415.6	FE, GUIDE, REPORT

Prepared by Mr. NITHIN C

Approved by HOD