Sri Indu Institute of Engineering & Technology

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Approved by AICTE, New Delhi
Affiliated to JNTUH, Hyderabad.

COURSE FILE

ON

ELECTROMAGNETIC FIELDS AND WAVES

Course Code – EC402PC

II B.Tech II-SEMESTER

A.Y.: 2022-2023

Prepared by

Mr. K. RAJENDER
Assistant Professor

Head of the Department
Electronics and Communication Engg. Dept
SRI INDU INSTITUTE OF ENGG & TECH

PRINCIPAL
Sri Indu Institute of Engineering & Tech
Sheriguda(Vill), Ibrahimpatnam
R.R. Dist. Telangana-501 510.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Year	2022-2023
Course Title	ELECTROMAGNETIC FIELDS AND WAVES
Course Code	EC402PC
Programme	B.Tech
Year & Semester	II year II-semester
Branch & Section	ECE-A
Regulation	R18
Course Faculty	Mr. K. RAJENDER, Assistant Professor

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INSTITUTE VISION AND MISSION

Vision:

To become a premier institute of academic excellence by providing the world class education that transforms individuals into high intellectuals, by evolving them as empathetic and responsible citizens through continuous improvement.

Mission:

IM1: To offer outcome-based education and enhancement of technical and practical skills.

IM2: To Continuous assess of teaching-learning process through institute-industry collaboration.

IM3: To be a centre of excellence for innovative and emerging fields in technology development with state-of-art facilities to faculty and students' fraternity.

IM4: To Create an enterprising environment to ensure culture, ethics and social responsibility among the stakeholders.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT VISION AND MISSION

Vision:

To become a recognized center in the field of Electronics and Communication Engineering by producing creative engineers with social responsibility and address ever-changing global challenges.

Mission:

DM1: To facilitate an academic environment that enables student's centric learning.

DM2: To provide state-of-the-art hardware and software technologies to meet industry requirements.

DM3: To continuously update the Academic and Research infrastructure.

DM4: To Conduct Technical Development Programs for overall professional caliber of Stake Holders.

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PROGRAM EDUCATIONAL OBJECTIVES

Program Educational objectives are to Promote:

PEO1: Graduates with a strong foundation in Electronics and Communication Engineering, Science and Technology to become successful in the chosen professional career.

PEO2: Graduates with ability to execute innovative ideas for Research and Development with continuous learning.

PEO3: Graduates inculcated with industry based soft-skills to enable employability.

PEO4: Graduates demonstrate with ability to work in interdisciplinary teams and ethical professional behavior.

PROGRAM SPECIFIC OUTCOMES

PSO 1: Design Skills: Design, analysis and development a economical system in the area of Embedded system & VLSI design.

PSO 2: Software Usage: Ability to investigate and solve the engineering problems using MATLAB, Keil and Xilinx.

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PROGRAM OUTCOMES

1. **ENGINEERING KNOWLEDGE**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **PROBLEM ANALYSIS**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **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.

4. **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.

5. **MODERN TOOL USAGE**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **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.

7. **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.

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

9. **INDIVIDUAL AND TEAM WORK**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **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, give and receive clear instructions.

11. **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.

12. **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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABADB.Tech. in ELECTRONICS AND COMMUNICATION
ENGINEERING COURSE STRUCTURE & SYLLABUS (R18)
Applicable From 2018-19 Admitted Batch

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EC301PC	Electronic Devices and Circuits	3	1	0	4
2	EC302PC	Network Analysis and Transmission Lines	3	0	0	3
3	EC303PC	Digital System Design	3	1	0	4
4	EC304PC	Signals and Systems	3	1	0	4
5	EC305ES	Probability Theory and Stochastic Processes	3	0	0	3
6	EC306PC	Electronic Devices and Circuits Lab	0	0	2	1
7	EC307PC	Digital System Design Lab	0	0	2	1
8	EC308ES	Basic Simulation Lab	0	0	2	1
9	*MC309	Constitution of India	3	0	0	0
		Total Credits	**18**	**3**	**6**	**21**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA401BS	Laplace Transforms, Numerical Methods & Complex Variables	3	1	0	4
2	EC402PC	Electromagnetic Fields and Waves	3	0	0	3
3	EC403PC	Analog and Digital Communications	3	1	0	4
4	EC404PC	Linear IC Applications	3	0	0	3
5	EC405PC	Electronic Circuit Analysis	3	0	0	3
6	EC406PC	Analog and Digital Communications Lab	0	0	3	1.5
7	EC407PC	IC Applications Lab	0	0	3	1.5
8	EC408PC	Electronic Circuit Analysis Lab	0	0	2	1
9	*MC409	Gender Sensitization Lab	0	0	2	0
		Total Credits	**15**	**2**	**10**	**21**

***MC – Satisfactory/Unsatisfactory**

EC402PC: ELECTROMAGNETIC FIELDS AND WAVES

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Pre-requisite: Applied Physics

Course Objectives:

- To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields, and apply them to solve physics and engineering problems.
- To distinguish between static and time- varying fields, and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems.
- To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagationparametersandestimatethesamefordielectricanddissipativemedia.
- To conceptually understand the waveguides and to determine the characteristics of rectangular waveguides, micro strip lines.

Course Outcomes: Upon completing this course, the student will be able to

- Get the knowledge of Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields.
- Distinguish between the static and time-varying fields; establish the corresponding sets of Maxwell's Equations and Boundary Conditions.
- Analyze the Wave Equations for good conductors, good dielectrics and evaluate the UPW Characteristics for several practical media of interest.
- To analyze completely the rectangular waveguides, their mode characteristics, and design waveguides for solving practical problems.

UNIT–I

Electrostatics: Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density. Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance –Parallel Plate, Coaxial, Spherical Capacitors.

UNIT–II

Magneto statics: Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.

UNIT–III

Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Forms, Conditions at a Boundary Surface - Dielectric-Dielectric and Dielectric-Conductor Interfaces.

UNIT–IV

EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definitions, Relation between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization.

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem.

UNIT–V

Waveguides: Electromagnetic Spectrum and Bands. Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Phase and Group Velocities, Wavelengths and Impedance Relations, Equation of Power Transmission, Impossibility of TEM Mode. Microstrip Lines – ZoRelations,Effective Dielectric Constant.

TEXTBOOKS:

1. EngineeringElectromagnetics–WilliamH.HaytJr.andJohnA.Buck,8thEd., McGrawHill,2014
2. PrinciplesofElectromagnetics–MatthewN.O.sadikuandS.V.Kulkarni,6thEd.,Oxford University Press, Aisan Edition, 2015.

REFERENCEBOOKS:

1. ElectromagneticWavesandRadiatingSystems–E.C.JordanandK.G.Balmain,2ndEd., 2000, PHI.
2. EngineeringElectromagnetics–NathanIda,2nd Ed.,2005,Springer(India)Pvt.Ltd.,New Delhi.

Course: ELECTROMAGNETIC FIELDS AND WAVES (C222) **Class: II ECE-A**

Course Outcomes

After completing this course the student will be able to:

C222.1	Apply the basic laws to derive the Maxwell's Equation in Differential and Integral form for solving the engineering problems in Electrostatics.	Creating, Applying, Understanding, Remembering
C222.2	Describe the knowledge of Magnetic scalar and vector potentials, Forces due to Magnetic Fields, Ampere's Force law.	Understanding Analyzing, Applying, Remembering
C222.3	Distinguish between static and Time varying fields; apply these concepts to derive the Maxwell's Equation in differential, Integral form and Boundary conditions for solving the engineering problems.	Understanding, Applying, Remembering
C222.4	Analyze the wave equation for good conductor and good dielectrics, criticize and apply the characteristics of uniform plane wave for practical problems.	Understanding, Applying, Analyzing, Remembering
C222.5	To analyze the characteristics of Uniform plane wave, determine their propagation parameters and estimate the same for dielectric and dissipative media.	Remembering , Understanding , Evaluating
C222.6	Analyze the rectangular waveguide, their mode characteristics and design waveguide for solving practical problems.	Understanding , Creating, Analyzing

Mapping of course outcomes with program outcomes:

High -3 Medium -2 Low-1

PO / CO	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
C222.1	3	2	-	-	-	-	1	1	1	2	-	3	1	2
C222.2	3	2	2	2	-	-	1	1	-	2	-	2	1	2
C222.3	3	2	2	-	-	-	1	1	-	2	-	3	2	1
C222.4	3	1	1	-	-	1	1	1	-	2	-	3	1	2
C222.5	2	3	2	1	-	-	1	1	-	2	2	2	2	1
C222.6	2	2	1	-	2	1	1	1	1	2	-	3	2	2
C222	**2.67**	**2.00**	**1.60**	**1.50**	**2.00**	**1.00**	**1.00**	**1.00**	**1.00**	**2.00**	**2.00**	**2.67**	**1.50**	**1.67**

Course: Electromagnetic fields and waves (C222) **Class: II ECE-A**

P01.ENGINEERING KNOWLEDGE: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

P02.PROBLEM ANALYSIS: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

P03.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 modelling 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.

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.

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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.

PSO1: DESIGN SKILLS: Design, analysis and development a economical system in the area of Embedded system & VLSI design

PSO2: SOFTWARE USAGE: Ability to investigate and solve the engineering problems using MATLAB, Keil and Xilinx.

CO-PO mapping Justification

C222.1 Apply the basic laws to derive the Maxwell's Equation in Differential and Integral form for solving the engineering problems in Electrostatics. (Creating, Applying, Understanding)

	Justification
PO1	Maxwell's Equations play a fundamental role in the field of electromagnetics and are essential for solving complex engineering problems, particularly in electrostatics.(level 3)
PO2	Analyze the problems of electrostatic fields using differentiation and integration. (level 2)
PO7	Engineers working on energy-efficient technologies contribute to environmental sustainability by minimizing power requirements and reducing the carbon footprint. (level 1)
PO8	Engineers must ensure that electromagnetic devices are designed with built-in security features to protect user data and privacy. (level 1)
PO9	Individual engineers should have an in-depth understanding of electromagnetic theory and electrostatics to successfully derive Maxwell's Equations. This knowledge forms the basis for proposing innovative solutions and optimizing designs. (level 1)
PO10	Engineers need to articulate the steps involved in the derivation process, ensuring that each step is clearly explained. (level 2)
PO12	Engineers who continually update their knowledge can easily adapt to shifts in industry standards, tools, and methodologies related to Maxwell's Equations. (level 3)
PSO1	Integrating electromagnetic field principles into the design of embedded systems and VLSI is essential for achieving efficient communication, power distribution, clock synchronization, EMI mitigation, and overall system performance. (level 1)
PSO2	By combining MATLAB, Keil, and Xilinx, engineers can seamlessly transition from simulation and algorithm development in MATLAB to embedded system implementation using Keil and FPGA-based solutions with Xilinx. This integration facilitates a comprehensive approach to solving engineering problems related to electromagnetic fields and waves, from theoretical analysis and simulation to real-world hardware implementation. (level 2)

C222.2 Describe the knowledge of Magnetic scalar and vector potentials, Forces due to Magnetic Fields, Ampere's Force law. (Understanding Analyzing, Applying)

	Justification
PO1	Engineers use mathematical techniques to integrate vector quantities, allowing them to calculate the force experienced by the conductor accurately. (level 3)
PO2	The differential form of Maxwell's Equations involves vector operators such as the gradient, divergence, and curl, making a strong foundation in vector calculus indispensable. (level 2)
PO3	Engineers leverage this knowledge to analyze and design systems involving electromagnetic interactions, including antennas, transmission lines, and electronic circuits. (level 2)
PO4	Engineers use differential equations to represent how these fields change with respect to spatial coordinates and time. (level 2)
PO7	Engineers working on energy-efficient technologies contribute to environmental sustainability by minimizing power requirements and reducing the carbon footprint. (level 1)
PO8	Engineers must ensure that electromagnetic devices are designed with built-in security features to protect user data and privacy. (level 1)
PO10	Engineers specializing in communications often deal with time-varying electromagnetic fields, such as those in radio frequency (RF) systems. Applying the concepts of time-varying fields is essential for designing efficient communication systems. (level 2)
PO12	Engineers who continually update their knowledge can easily adapt to shifts in industry standards, tools, and methodologies related to Maxwell's Equations. (level 2)
PSO1	Integrating electromagnetic field principles into the design of embedded systems and VLSI is essential for achieving efficient communication, power distribution, clock synchronization, EMI mitigation, and overall system performance. (level 1)
PSO2	By combining MATLAB, Keil, and Xilinx, engineers can seamlessly transition from simulation and algorithm development in MATLAB to embedded system implementation using Keil and FPGA-based solutions with Xilinx. This integration facilitates a comprehensive approach to solving engineering problems related to electromagnetic fields and waves, from theoretical analysis and simulation to real-world hardware implementation. (level 2)

C222.3 Distinguish between static and Time varying fields; apply these concepts to derive the Maxwell's Equation in differential, integral form and Boundary conditions for solving the engineering problems. (Understanding, Applying)

	Justification
PO1	The application of vector calculus allows engineers to express the relationships between electric and magnetic fields in differential equations. (level 3)
PO2	Engineers apply their specialization knowledge to tailor Maxwell's Equations to specific engineering problems. (level 2)
PO3	Engineers apply numerical techniques and simulations to analyze electromagnetic phenomena and optimize designs. (level 2)
PO7	Engineers working on energy-efficient technologies contribute to environmental sustainability by minimizing power requirements and reducing the carbon footprint. (level 1)
PO8	Engineers must ensure that electromagnetic devices are designed with built-in security features to protect user data and privacy. (level 1)
PO10	Engineers need to articulate the steps involved in the derivation process, ensuring that each step is clearly explained. (level 2)

PO12	The ability to engage in independent and life-long learning is essential for engineers to keep pace with technological changes, particularly in the dynamic field of electromagnetic fields and waves. It allows for a deep understanding of static and time-varying fields, the derivation and application of Maxwell's Equations, and the skill to apply this knowledge to solve real-world engineering problems. (level 3)
PSO1	Integrating electromagnetic field principles into the design of embedded systems and VLSI is essential for achieving efficient communication, power distribution, clock synchronization, EMI mitigation, and overall system performance. (level 2)
PSO2	By combining MATLAB, Keil, and Xilinx, engineers can seamlessly transition from simulation and algorithm development in MATLAB to embedded system implementation using Keil and FPGA-based solutions with Xilinx. This integration facilitates a comprehensive approach to solving engineering problems related to electromagnetic fields and waves, from theoretical analysis and simulation to real-world hardware implementation. (level 1)

C222.4 Analyze the wave equation for good conductor and good dielectrics, criticize and apply the characteristics of uniform plane wave for practical problems. (Understanding, Applying, Analyzing)

	Justification
PO1	Engineers use mathematical techniques to analyze and solve these equations, providing insights into wave propagation, reflection, and transmission. (level 3)
PO2	In the context of wave equations, complex analysis is often employed to represent the electric and magnetic fields as complex phasors. This simplifies the mathematical analysis of waves and facilitates the understanding of their behavior in different media. (level 1)
PO3	Engineers specializing in antenna design use the characteristics of wave propagation to design efficient antennas for communication systems. (level 1)
PO6	Engineers must assess and minimize potential health risks associated with electromagnetic radiation, especially in applications where the public or workers may be exposed to high-intensity fields. (level 1)
PO7	Engineers working on energy-efficient technologies contribute to environmental sustainability by minimizing power requirements and reducing the carbon footprint. (level 1)
PO8	Engineers must ensure that electromagnetic devices are designed with built-in security features to protect user data and privacy. (level 1)
PO10	Engineers must assess and minimize potential health risks associated with electromagnetic radiation, especially in applications where the public or workers may be exposed to high-intensity fields. (level 2)
PO12	Engineers, through life-long learning, can continuously expand their knowledge base, delving into advanced theories, research findings, and practical applications of wave equations and electromagnetic wave characteristics. (level 3)
PSO1	Integrating electromagnetic field principles into the design of embedded systems and VLSI is essential for achieving efficient communication, power distribution, clock synchronization, EMI mitigation, and overall system performance. (level 1)
PSO2	By combining MATLAB, Keil, and Xilinx, engineers can seamlessly transition from simulation and algorithm development in MATLAB to embedded system implementation using Keil and FPGA-based solutions with Xilinx. This integration facilitates a comprehensive approach to solving engineering problems related to electromagnetic fields and waves, from theoretical analysis and simulation to real-world hardware implementation. (level 2)

C222.5 To analyze the characteristics of Uniform plane wave, determine their propagation parameters and estimate the same for dielectric and dissipative media. (Remembering, Understanding, Evaluating)

	Justification
PO1	A solid foundation in mathematics is essential for analyzing wave equations, including those describing uniform plane waves. This involves the use of partial differential equations and vector calculus to represent and manipulate electric and magnetic fields in different media. (level 2)
PO2	The analysis of sinusoidal time-varying phenomena and allows engineers to understand the behavior of uniform plane waves. (level 3)
PO3	Solving the different complex problem on propagation parameters of Uniform plane wave. (level 2)
PO4	Research-based investigations may involve empirical estimation, where measurements and experiments are conducted to determine these parameters in specific dielectric and dissipative media. (level 1)
PO7	Engineers working on energy-efficient technologies contribute to environmental sustainability by minimizing power requirements and reducing the carbon footprint. (level 1)
PO8	Engineers must ensure that electromagnetic devices are designed with built-in security features to protect user data and privacy. (level 1)
PO10	Engineers need to articulate the steps involved in the derivation process, ensuring that each step is clearly explained. (level 2)
PO11	Integrate theoretical knowledge with practical applications, illustrating how these principles are applied in real-world scenarios, both in project management and electromagnetic wave analysis. (level 2)
PO12	In the field of electromagnetic wave theory and engineering, technology is constantly evolving. New materials, tools, and analytical methods are developed. Recognizing the need for continuous learning is essential to stay updated with the latest advancements. (level 2)
PSO1	Integrating electromagnetic field principles into the design of embedded systems and VLSI is essential for achieving efficient communication, power distribution, clock synchronization, EMI mitigation, and overall system performance. (level 2)
PSO2	By combining MATLAB, Keil, and Xilinx, engineers can seamlessly transition from simulation and algorithm development in MATLAB to embedded system implementation using Keil and FPGA-based solutions with Xilinx. This integration facilitates a comprehensive approach to solving engineering problems related to electromagnetic fields and waves, from theoretical analysis and simulation to real-world hardware implementation. (level 1)

C222.6 Analyze the rectangular waveguide, their mode characteristics and design waveguide for solving practical problems (Understanding, Creating, Analyzing)

	Justification
PO1	Mathematical techniques are applied to find the eigen values and eigen vectors corresponding to the different modes supported by the waveguide. (level 2)
PO2	Analyze the mode characteristics of rectangular waveguide. (level 2)
PO3	Design of rectangular waveguide and its mode characteristics. (level 1)
PO5	Research based analysis on rectangular waveguide and its mode characteristics. (level 2)

PO6	Engineers need to consider the social context to ensure that the use of waveguides aligns with societal needs and values, contributing positively to communication infrastructure and technological advancements. (level 1)
PO7	Engineers must consider the environmental impact of their designs, minimizing negative effects and exploring sustainable practices in the life cycle of waveguide technology. (level 1)
PO8	The ethical design of waveguide systems requires engineers to balance technological advancements with the well-being of individuals and society. (level 1)
PO9	Collaborative analysis allows for a more thorough examination of waveguide characteristics, ensuring a comprehensive understanding of how different factors influence performance. (level 1)
PO10	Engineers need to articulate the steps involved in the derivation process, ensuring that each step is clearly explained. (level 2)
PO12	Continuous learning fosters an innovative mindset, encouraging engineers to think creatively and push the boundaries of traditional waveguide design. (level 3)
PSO1	Integrating electromagnetic field principles into the design of embedded systems and VLSI is essential for achieving efficient communication, power distribution, clock synchronization, EMI mitigation, and overall system performance. (level 2)
PSO2	By combining MATLAB, Keil, and Xilinx, engineers can seamlessly transition from simulation and algorithm development in MATLAB to embedded system implementation using Keil and FPGA-based solutions with Xilinx. This integration facilitates a comprehensive approach to solving engineering problems related to electromagnetic fields and waves, from theoretical analysis and simulation to real-world hardware implementation. (level 2)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

B. Tech./B.Pharm. II YEAR I & II SEMESTERS

I SEM

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork	**28.11.2022**	
2	1st Spell of Instructions	28.11.2022	21.01.2023 (8 Weeks)
3	First Mid Term Examinations	23.01.2023	30.01.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	04.02.2023	
5	2nd Spell of Instructions	31.01.2023	29.03.2023 (8 Weeks)
6	Second Mid Term Examinations	31.03.2023	08.04.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	10.04.2023	15.04.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	15.04.2023	
9	End Semester Examinations	17.04.2023	29.04.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 93

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	**01.05.2023**	
2	1st Spell of Instructions (including Summer Vacation)	01.05.2023	08.07.2023 (10 Weeks)
3	**Summer Vacation**	15.05.2023	27.05.2023 (2 Weeks)
4	First Mid Term Examinations	10.07.2023	15.07.2023 (1 Week)
5	Submission of First Mid Term Exam Marks to the University on or before	22.07.2023	
6	2nd Spell of Instructions	18.07.2023	11.09.2023 (8 Weeks)
7	Second Mid Term Examinations	12.09.2023	16.09.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	19.09.2023	23.09.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	23.09.2023	
10	End Semester Examinations	25.09.2023	07.10.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 92

24/11/22

REGISTRAR

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

UGC Autonomous, Accredited by NAAC A+ Grade, Recognized under 2(f) of UGC Act 1956.
(Approved by AICTE, New Delhi and Affiliated to JNTUH, Hyderabad)
Khalsa Ibrahimpatnam, Sheriguda(V), Ibrahimpatnam(M), Ranga Reddy Dist., Telangana – 501 510
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Class Timetable

CLASS: II-B.Tech ECE-A | A.Y:2022-23 | SEMESTER: II | LH: C-101

TIME/ DAY	I 9:40-10:30	II 10:30 -11:20	III 11:20-12:10	IV 12:10-1:00	1:00-1:30	V 1:30-2:20	VI 2:20-3:10	VII 3:10-4:00
MON	LTNM	LICA	EMF&W	A&DC	LUNCH	ECA	EMF&W	A&DC(T)/LTNM(T)
TUE	A&DC	LICA	COUN	ECA		LTNM	CO-CU/DAA	
WED	LICA	A&DC	EMF&W	LTNM		ICA LAB / A&DC LAB		
THU	ECA	EMF&W	A&DC	LICA		A&DC LAB / ICA LAB		
FRI	LTNM	ECA	ECA LAB / GS LAB			LTNM(T)/A&DC(T)	LICA	SPORTS
SAT	EMF&W	ECA	LIB	A&DC		LTNM	GS LAB / ECA LAB	

*(T) – Tutorial Concern Faculty

Course Code	Course Name	Name of the Faculty	Course Code	Course Name	Name of the Faculty
MA401BS	LTNM-Laplace Transforms, Numerical Methods & Complex Variables	T.Thirupathi Reddy	EC406PC	A&DC LAB-Analog and Digital Communications Lab	B.Jyothirmai/K.Rajender/T.Bhavani
EC402PC	EMF&W-Electromagnetic Fields and Waves	K.Rajender	EC407PC	ICA LAB-IC Applications Lab	A.Vaani/G.Anitha/T.Divya
EC403PC	A&DC-Analog and Digital Communications	B.Jyothirmai	EC408PC	ECA LAB-Electronic Circuit Analysis Lab	G.Nirmala/G.Anusha/Y.Rajani
EC404PC	LICA-Linear IC Applications	G.Anitha	*MC409	GS LAB-Gender Sensitization Lab	G.Ananda Rao
EC405PC	ECA-Electronic Circuit Analysis	G.Nirmala	COUN	Counseling	I.Venu/G.Nirmala/A.Swetha
			SPORTS	Sports	Dr.S.Suresh/I.Venu
			CO-CU/DAA	Co-Curricular/Dept. Assoc.Activities	G.Nirmala/D.Aruna Kumari/K.Bhaskar Reddy
			LIB	Library	S.Alekhya/M.Srilatha

Class Incharge

Head of the Department
Electronics and Communication Engg. Dept
SRI INDU INSTITUTE OF ENGG & TECH
Sheriguda(V), Ibrahimpatnam(M), R.R.Dist-501 510

Principal
PRINCIPAL
Sri Indu Institute of Engineering & Tech.
Sheriguda(Vill), Ibrahimpatnam,
R.R. Dist. Telangana -501 510

LESSON PLAN

Programme: B.Tech	Academic Year: 2022-23
Year: II	Semester: II
Course Title: Electromagnetic fields and waves	Course Code: EC402PC
Name of Faculty: K.Rajender	Number of lectures per week:3

Unit-I Syllabus

Electrostatics: Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density. Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance –Parallel Plate, Coaxial, Spherical Capacitors.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
02	Introduction to EMW, Coordinate systems, scalars and vectors	T1,W1	BB
01	Coulomb's Law	T1,R2	BB
02	Electric Field Intensity – Fields due to Different Charge Distributions	T1,W2	BB
02	Electric Flux Density, Gauss Law and Applications	T1	BB
01	Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields	T1	BB
01	Energy Density	T1,R2	BB
01	Convection and Conduction Currents, Dielectric Constant	T1	BB
01	Isotropic and Homogeneous Dielectrics, Continuity Equation	T1,R2	BB
02	Relaxation Time, Poisson's and Laplace's Equations	T1	BB
02	Capacitance –Parallel Plate, Coaxial, Spherical Capacitors	T1	BB
02	Problems	T1,R1	BB
Gap beyond syllabus(if any):			
Gap within the syllabus(if any)			
Course Outcome 1: Apply the basic laws to derive the Maxwell's Equation in Differential and Integral form for solving the engineering problems in Electrostatics.			

*Session Duration: 50 minutes

*Total Number of Hours/Unit: 17

Course Title: Electromagnetic fields and waves	Course Code: EC402PC

Unit-II Syllabus

Magneto statics: Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
01	Biot-Savart's Law	T1,R1	BB
02	Ampere's Circuital Law and Applications	T1,R1	BB
01	Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields	T1	BB
01	Magnetic Scalar and Vector Potentials,	T1	BB
02	Forces due to Magnetic Fields	T1	BB
02	Ampere's Force Law	T1	BB
02	problems	T1,R1	BB
Gap beyond syllabus(if any):			
Gap within the syllabus(if any)			
Course Outcome 1: Describe the knowledge of Magnetic scalar and vector potentials, Forces due to Magnetic Fields, Ampere's Force law.			

*Session Duration: 50 minutes

*Total Number of Hours/Unit: 11

Course Title: Electromagnetic fields and waves	Course Code: EC402PC

Unit-III Syllabus

Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Forms, Conditions at a Boundary Surface - Dielectric-Dielectric and Dielectric-Conductor Interfaces.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
02	Faraday's Law and Transformer EMF	T1,R2	BB
02	Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Forms,	T1,R2	BB
02	Conditions at a Boundary Surface - Dielectric-Dielectric	T1,R2	BB
02	Dielectric-Conductor Interfaces	T1, R2	BB
02	Problems	T1,R2	BB
Gap beyond syllabus(if any):			
Gap within the syllabus(if any)			
Course Outcome 1: Distinguish between static and Time varying fields; apply these concepts to derive the Maxwell's Equation in differential, Integral form and Boundary conditions for solving the engineering problems.			

*Session Duration: 50minutes

*Total Number of Hours/Unit: 10

Course Title: Electromagnetic fields and waves	Course Code: EC402PC

Unit-IV Syllabus

EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definitions, Relation between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization.

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
01	Wave Equations for Conducting and Perfect Dielectric Media	T1,R2	BB
01	Uniform Plane Waves – Definitions	T1,W3	BB
02	Relation between E & H, Sinusoidal Variations, Problems	T1,R2	BB
01	Wave Propagation in Lossy Media	T1,R2	BB
01	Wave Propagation in Lossless and Conducting Media	T1,R1	BB
01	Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors	T1, R1	BB
01	Wave Propagation in Good Dielectrics, Polarization	T1,W3	BB
02	Normal and Incidence for both Perfect Conductor and Perfect Dielectrics	T1,R1	BB
02	Oblique Incidence for both Perfect Conductor and Perfect Dielectrics	T1,R2	BB
01	Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance	T1,R2	BB
02	Poynting Vector and Poynting Theorem, Problems	T1,R2	BB
Gap beyond syllabus(if any):			
Gap within the syllabus(if any)			
Course Outcome 1: Analyze the wave equation for good conductor and good dielectrics, criticize and apply the characteristics of uniform plane wave for practical problems. **Course Outcome 2:** To analyze the characteristics of Uniform plane wave, determine their propagation parameters and estimate the same for dielectric and dissipative media.			

*Session Duration: 50minutes

*Total Number of Hours/Unit: 15

Course Title: Electromagnetic fields and waves	Course Code: EC402PC

Unit-V Syllabus

Waveguides: Electromagnetic Spectrum and Bands. Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Phase and Group Velocities, Wavelengths and Impedance Relations, Equation of Power Transmission, Impossibility of TEM Mode. Microstrip Lines – Z_oRelations, Effective Dielectric Constant.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
01	Electromagnetic Spectrum and Bands	T2,R2	BB
02	Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates	T2,R2	BB
01	TE/TM mode analysis	T2,R2	BB
02	Expressions for Fields	T2,R2	BB
01	Characteristic Equation and Cut-off Frequencies	T2,R2	BB
01	Dominant and Degenerate Modes	T2,R2	BB
01	Sketches of TE and TM mode fields in the cross-section	T2,R1	BB
01	Phase and Group Velocities	T2,R1	BB
01	Wavelengths and Impedance Relations	T2,R1	BB
01	Equation of Power Transmission	T2,R1	BB
01	Impossibility of TEM Mode	T2,R1	BB
02	Microstrip Lines – Z_oRelations	T2,R1	BB
01	Effective Dielectric Constant	T2,R1	BB
Gap beyond syllabus(if any):			
Gap within the syllabus(if any)			
Course Outcome 1: Analyze the rectangular waveguide, their mode characteristics and design waveguide for solving practical problems.			

*Session Duration: 50minutes
*Total Number of Hours/Unit: 16

Text Books:

1. EngineeringElectromagnetics–WilliamH.HaytJr.andJohnA.Buck,8th Ed., McGrawHill,2014
2. PrinciplesofElectromagnetics–MatthewN.O.sadikuandS.V.Kulkarni,6th Ed.,Oxford University Press, Aisan Edition, 2015.

Reference Books:

1. ElectromagneticWavesandRadiatingSystems–E.C.JordanandK.G.Balmain,2nd Ed.,2000, PHI.
2. EngineeringElectromagnetics–NathanIda,2nd Ed.,2005,Springer(India)Pvt.Ltd.,New Delhi.

Web References for Electromagnetic fields and waves:

S.NO	WEB LINK
1	https://phys.libretexts.org/Bookshelves/Classical_Mechanics/Classical_Mechanics_(Dourmashkin)/03%3A_Vectors/3.02%3A_Coordinate_Systems#:~:text=There%20are%20three%20commonly%20used,and%20a%20cylindrical%20coordinate%20system.
2	https://unacademy.com/content/jee/study-material/chemistry/electric-field-due-to-continuous-charge-distribution/
3	https://www.electronicshub.org/electromagnetic-waves/

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Lecture notes

Unit 1 link:

https://drive.google.com/file/d/1nln4FHiA-HHEdy2iRHlRF8tsykYBjMHc/view?usp=sharing

Unit 2 link:

https://drive.google.com/file/d/1S6ypQYzjn97ptkxmALrrPH2S1DcsOhRo/view?usp=sharing

Unit 3 link:

https://drive.google.com/file/d/1BTD9SM7DBcnhr2eA97_JsSIddnNKVKab/view?usp=sharing

Unit 4 link:

https://drive.google.com/file/d/13gnMsqUV4IHG9kzEtQYUa1qao79WNZLR/view?usp=sharing

Unit 5 link:

https://drive.google.com/file/d/12jvRk6a5UuiGmVs1XWyf76-7_9kn5Klb/view?usp=sharing

Power point presentation

PPT link:

https://docs.google.com/presentation/d/1f2FsqyZR1t4lz0M2hje_eDGtMNnXgwbP/edit?usp=sharing&ouid=106700162151853541587&rtpof=true&sd=true

Code No: 154AV **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, November/December - 2020
ELECTROMAGNETIC FIELDS AND WAVES
(Electronics and Communication Engineering)

Time: 2 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Using Gauss's law, find $\overline{E}$ at any point due to long infinite charged wire.
b) Derive the expression for energy stored and energy density in a static electric field. [8+7]

2.a) What is the capacitance between two concentric spheres and obtain an expression for it.
b) State and explain Biot-Savart law. [7+8]

3.a) Define and explain the terms scalar and vector magnetic potential. How to determine these quantities for a magnetic field.
b) A steady current element $10^{-3}\,\overline{a_z}$Am is located at the origin in free space. What is the magnetic field B due to this element at point (0,0,1) m. [8+7]

4.a) Write Maxwell's equations for free space in both point and integral form.
b) Derive boundary conditions between two perfect dielectrics. [8+7]

5.a) Explain modified ampere's law for time varying fields.
b) Derive the equation of continuity for time varying fields. [8+7]

6.a) A plane wave travelling in air is normally incident on a material with $\varepsilon_r = 4$ and $\mu_r = 1$ Find the reflection and transmission coefficients.
b) State and prove Poynting theorem. [8+7]

7.a) Explain why the wavelength in a rectangular waveguide is greater than the free space wavelength.
b) The magnetic field in the TE_{10} mode in a rectangular waveguide is given by $H_\omega = -\frac{j\beta a}{\pi}\sin\frac{\pi x}{a}e^{j(\omega t-\beta z)}$, $H_z = \cos\frac{\lambda x}{a}e^{j(\omega t-\beta z)}$, $H_y = 0$. Using Maxwell's equations determine the components of the electric field E. [7+8]

8.a) Derive the field component for TE waves in a metal rectangular waveguide.
b) Explain about dominant and degenerate modes. [9+6]

---ooOoo---

CodeNo: 154AV **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester (Special) Examinations, January/February-2021
ELECTROMAGNETIC FIELDS AND WAVES
(Electronics and Communication Engineering)

Time: 2 hours **Max.Marks:75**

Answer any five questions
All questions carry equal marks
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1. a) Derive the expression for $\overline{D}$ due to point charge and hence deduce the relation between $\overline{D}$ and $\overline{E}$.
   b) Derive the expression for capacitance of spherical capacitor. [10+5]

2. State and prove Maxwell's equations for electrostatic fields. [15]

3. Derive the expression for force between two current carrying conductors. [15]

4. Using Ampere's circuital law, find $\overline{H}$ due to infinitely long straight conductor. [15]

5. Explain Faraday's law for time varying fields. [15]

6. Derive boundary conditions between conductor and dielectric interface. [15]

7. a) Find the wave equations governing the E and H fields in a source free conducting medium with parameters ε, μ, σ.
   b) What are the wave equations for a lossless medium and a conducting medium for sinusoidal variations? [7+8]

8. a) Define the Poynting vector, average power and instantaneous power.
   b) Write the general instantaneous field expressions for the TM and TE modes. Deduce those for TE_{01} mode. [6+9]

---ooOoo---

CodeNo: 154AV **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, August/September-2021
ELECTROMAGNETIC FIELDS AND WAVES
(Electronics and Communication Engineering)

Time: 3 Hours **Max.Marks: 75**

Answer any five questions
All questions carry equal marks
---

1. a) Define electric field intensity at a point. Derive the expression for infinite line charge.
   b) Find E due to infinite surface charged is tribution by using Gauss's law. [10+5]

2. a) Establish Poisson's and Laplace's equations from Gauss's law.
   b) State and explain Biot-Savart's law. Derive the magnetic field produce at a point due to an infinite line current distribution. [10+5]

3. a) State and explain Faraday's laws.
   b) Explain "Inconsistency of Ampere's law"? [8+7]

4. a) A plane wave propagating through a medium with $\varepsilon_r=10, \mu_r=2$has E $=0.5\, e^{-z/3} \sin(10^8 t - \beta z)\, a_x$V/m. Determine:
   i)Phase constant ii)The loss tangent iii)Intrinsic impedance
   iv)Wave velocity v)H field.
   b) Define the reflection coefficient and derive the expression for input impedance In terms Of reflection coefficient? [10+5]

5.a) Define and explain magnetic scalar and vector potentials.
   b) State and explain Ampere's Circuital Law. [10+5]

6.a) Explain the solution of wave equation in a rectangular wave guide.
   b) Discuss the properties and characteristics of waveguide. [8+7]

7. Obtain Maxwell's equations in different forums for time varying fields. [15]

8. Derive the continuity equation. [15]

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Code No: 154AV **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, July/August - 2021
ELECTROMAGNETIC FIELDS AND WAVES
(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Applying Gauss's law obtain an expression for electric field intensity and electric flux density due to an infinite sheet of conductor of charge density ρ C/cm.
b) Point charges Q_1 and Q_2 are respectively located at (4,0,-3) and (2,0,1). If Q_1=4nC, find another point charge when
i) Electric field intensity on a charge at a point (5, 0,6) has no z-component.
ii) Force on a charge at a point (5,0,6) has no x-component. [6+9]

2.a) A charge Q_1 = -10 nC is at the origin in free space. If the X- component of E is to be zero at the point (3,1,1) what charge Qt should be kept at the point (2,0,0)
b) Derive Poisson's and Laplace's equation starting from Gauss's law. Also mention few salient features and limitation of Gauss's law. [6+9]

3.a) Derive the expression for magnetic field intensity and magnetic flux density due to finite and infinite line by applying Biot Savarts law
b) Explain the concepts of scalar magnetic potential and vector magnetic potential? Find the maximum torque on an 85 turns rectangular coil with dimension (0.2×0.3) m carrying a current of 5 Amps in a field B = 6.5T [7+8]

4.a) Using Ampere circuital law determine the magnetic field intensity due to a infinite long wire carrying a current I, also if a differential current element Idz is located at the origin of free space, obtain the expression for vector magnetic field potential due to the current element and hence find the magnetic field intensity at the point.
b) Derive an expression for magnetic field strength H, due to a finite filamentary conductor carrying a current I and placed along Z – axis at a point 'P' on Y-axis. Hence deduce the magnetic field strength for the length of the conductor extending from - ∞ to ∞. [7+8]

5.a) Define faradays laws. What are the different ways of emf generation? Explain with governing equation and suitable example for each? Also derive the differential and integral form of faradays law.
b) Derive the magnetic boundary condition at the interface between two magnetic medium. [7+8]

6.a) Define polarization of an electromagnetic wave. How an elliptically polarized wave can be specified uniquely.
b) Illustrate the reflection by a perfect conductor at oblique incidence. Formulate the expressions for electric field for Perpendicular polarization. [7+8]

7.a) A waveguide has an internal breadth of 3 cm and carries the dominant mode of a signal of unknown frequency. If the characteristic wave impedance is 500 Ω. Determine the frequency of propagation.

b) Derive the expressions for all the field components for TE modes in a rectangular waveguide. [5+10]

8.a) In an air-filled rectangular waveguide, the cut-off frequency of a TE 10 mode is 5 GHz, where as that of TE 01 mode is 2 GHz. Calculate the dimension of the guide, the cutoff frequency of next three higher order modes.

b) Show that a TEM wave cannot exist in a hollow cylindrical waveguide? [10+5]

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SET-1

I- Mid Examinations, JULY -2023

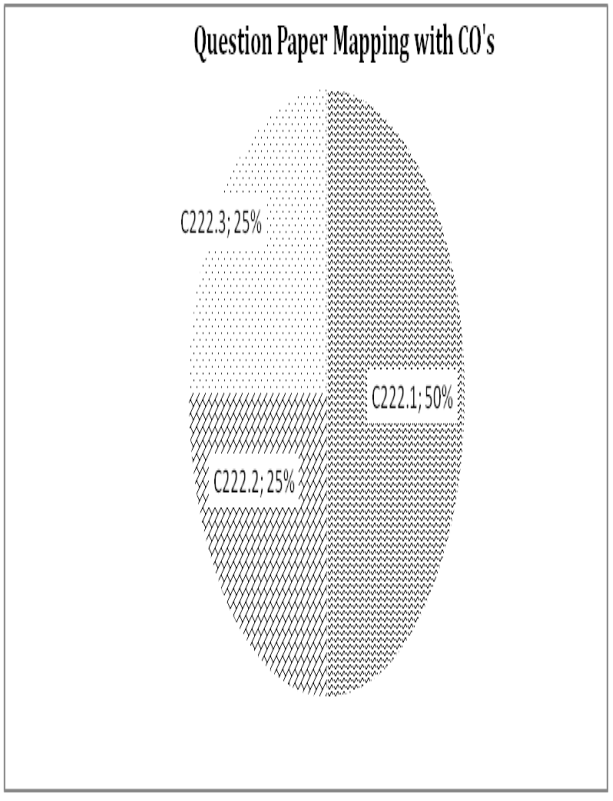
Year &Branch: II ECE A **Date: 10/07/2023**

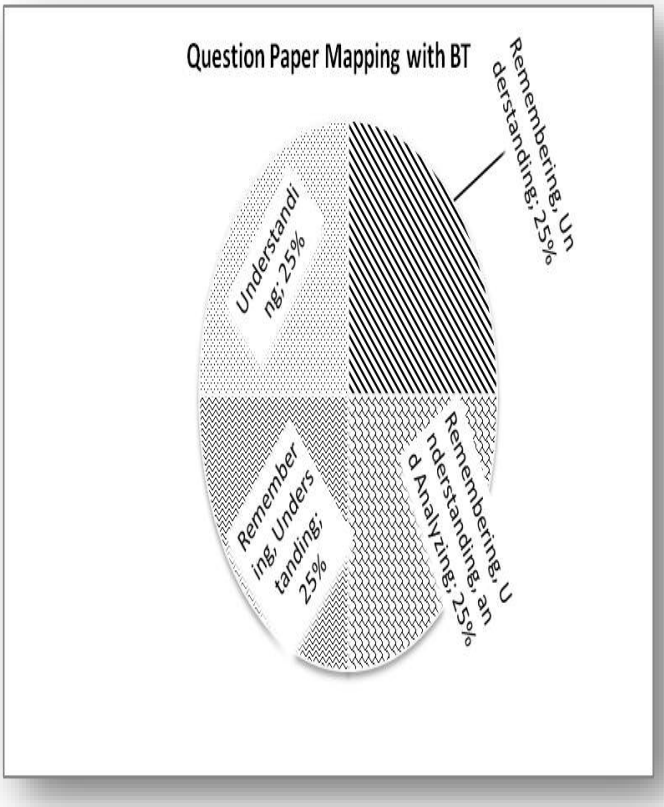
Subject: EMF&W **Max. Marks: 10** **Time: 60 mins**

Answer any **TWO** Questions. All Question Carry Equal Marks 2*5=10

(This question paper is prepared with Course Outcome and BT's mapping)

1. State and Explain the Gauss's law with any one of the applications?
   (C222.1) (Remembering, Understanding)
2. Define Capacitance and Derive the Capacitance for Spherical Capacitor?
   (C222.1) (Remembering, Understanding, and Analyzing)
3. State and Explain Biot-Savert's law with example?
   (C222.2) (Remembering, Understanding)
4. Explain Faraday's law. (C222.3) (Understanding)





Sri Indu Institute of Engineering & Technology

Sheriguda (V), Ibrahimpatnam (M), R.R.Dist-501 510

B-Tech I - Mid Examinations, JULY-2023

Objective Type Exam

Year & Branch: II –ECE-A Date: 10 /07/2023

Subject: **EMF&W** Max. Marks: 10 Time: 20 mins

Name: ……Roll No……

I. Choose the correct answers.

1. Which one of the following represents correct units for electric field strength? [ ]

A) T B) N/C C) J / C D) $N \cdot m^2 / C^2$

2. The flow of charge per unit time defines [ ]

A) Power B) current C) voltage D) resistance

3. The conservation of electric charge implies that [ ]

A) Charge can't be created

B) Charge can't be destroyed

C) The number of charged particle in the universe is constant

D) Simultaneous creation of equal and opposite charges is permissible

4. The unit of intensity of electric field is [ ]

A) metre/volt

B) Joule/newton

C) Coulomb/newton

D) Newton/coulomb

5. If a +ve charge is moved from low to high potential region, the electric potential energy [ ]

A) decreases

B) increases

C) remain the same

D) may increase or decrease

6. Coulomb's law is given by $F= Kq_1q_2r^n$, where n is [ ]

A) ½ B) -2 C) 2 D) -1

7. If the sizes of charged bodies are very small compared to the distances between them, we treat them as [ ]

A) Zero charges

B) Point charges

C) Single charge

D) No charges

8. The formula for electrostatic potential is _____. [ ]

A) Electrostatic potential = Work done*charge

B) Electrostatic potential = Work done/charge

C) Electrostatic potential = Work done +charge

D) Electrostatic potential = Work done-charge

9. The work done in moving a unit positive test charge over a closed path in an electric field is _____. [ ]

A) Always 1

B) Infinite

C) Zero

D) Negative

10. A surface that has the same electrostatic potential at every point on it is known as __ [ ]

A) Equal-potential surface

B) Same potential surface

C) Equi-magnitude surface

D) Equipotential surface

II. Fill in the Blanks

1. The electric field intensity due to a line charge distribution E=_____

2. The differential or point form of gauss's law ----------

3. The energy density in electrostatic field's _____.

4._____ is an example for convection current.

5. The conduction current density (J) = _____

6. The relationship between D and E is _____

7. _____ is the time it takes a charge placed in the interior of a material to drop to 36.8% of its initial value.

8. The Poisson's equations is _____

9. The Laplace's equation is_____

10. The ratio of the permittivity of the dielectric to that of free space is_____

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SET-II

II- Mid Examinations, SEPTEMBER -2023

Year &Branch: II ECE A **Date: 11/09/2023**

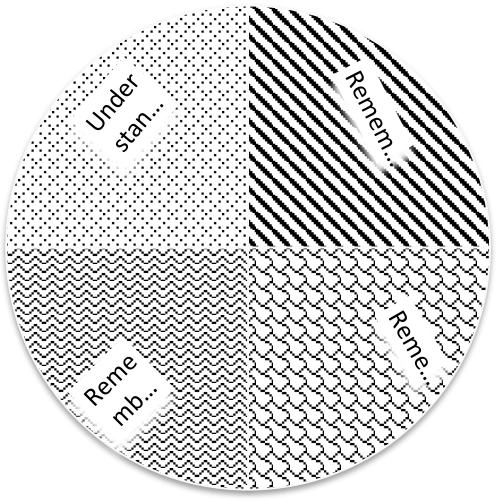
Subject: EMF&W **Max. Marks: 10** **Time: 60 mins**

Answer any **TWO** Questions. All Question Carry Equal Marks 2*5=10

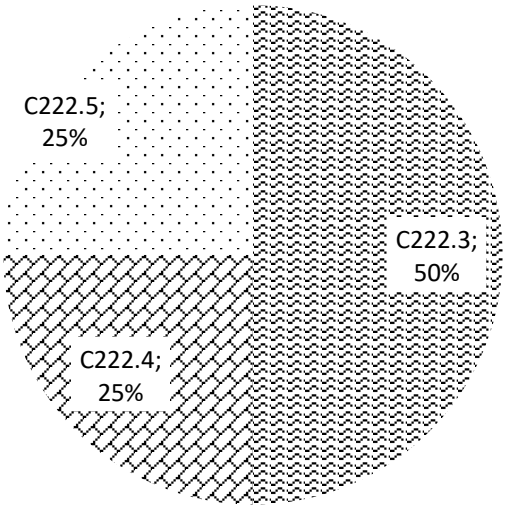
(This question paper is prepared with Course Outcome and BT's mapping)

1. State the boundary conditions in electrostatic fields and prove any one of them? (C222.3) (Remembering, Understanding)
2. State the Poynting Theorem and derive the necessary expressions. (C222.3) (Remembering, Understanding and Analyzing)
3. Describe the wave propagation in perfect dielectric, good dielectric and good Conducting medium? (C222.4) (Remembering, Understanding)
4. Derive the wave equations for TM mode in Rectangular Wave guide. (C222.5) (Understanding)

Question Paper Mapping with BT



Question Paper Mapping with CO's



Sri Indu Institute of Engineering & Technology

Sheriguda (V), Ibrahimpatnam (M), R.R.Dist-501 510

B-Tech II - Mid Examinations, SEPTEMBER-2023

Objective Type Exam

Year & Branch: II –ECE-A Date: 11 /09/2023

Subject: **EMF&W** Max. Marks: 10 Time: 20 mins

Name: ……Roll No……

I. Choose the correct answers.

1. Electromagnetic waves are produced by? [ ]

A) A static charge B) An accelerated charge

C) A moving charge D) Charged particles

2. Linear polarization can be obtained only if the wave consists of _____ [ ]

A) E_x B) E_y C) Both E_x & E_y & in phase D) Both E_x & E_y & out of phase

3. Which equations are regarded as wave equations in frequency domain for lossless media? [ ]

A) Maxwell's B) Lorentz C) Helmholtz D) Poisson's

4. Which among the following exhibits perpendicular nature in TEM wave? [ ]

A) Electric field B) Magnetic field

C) Direction of propagation D) All of the above

5. The part of the spectrum of the electromagnetic radiation used to cook food is [ ]

A) Ultraviolet rays B) cosmic rays C) X rays D) microwaves

6. The waves in a waveguide [ ]

A) travel along the border walls of the waveguide

B) are reflected from the side walls but do not travel along them

C) travel through the dielectric without touching the walls

D) travel along all the four walls

7. The cut-off frequency of a waveguide depends on [ ]

A) dimensions of the waveguide

B) wave mode

C) The dielectric property of the medium in the waveguide

D) all

8. The dominant TE mode in rectangular waveguides is [ ]

A) TE_{01} B) TE_{11} C) TE_{20} D) TE_{10}

9. A plane electromagnetic wave propagating along x direction can have the following pairs of E and B [ ]

A) E_x, B_y B) E_y, B_z C) B_x, E_y D) None of these

10. The direction of propagation of EM wave is obtained from [ ]

A) E x H B) E.H C) E D) H

II. Fill in the Blanks

1. The velocity of electromagnetic radiation in a medium of permittivity ε_0 and permeability μ_0 is given by _____
2. The ratio of transmitted wave and incident wave is called as _____
3. The ratio of reflected wave and incident wave _____
4. Intrinsic impedance of free space is _____
5. The velocity with which energy propagates in a waveguide is called _____
6. _____ is the same for TE and TM modes in a waveguide
7. The field components in a waveguide are obtained using_____
8. TEM wave means _____
9. If E = COS $(6x10^7 t - \beta z)a_x$, β is_____
10. Brewster angle is given by_____

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Website: https://siiet.ac.in/

SET-I

I- Mid Examinations, JULY -2023

Year &Branch: II ECE A **Date: 10/07/2023**
Subject: EMF&W

ANSWER KEY

Descriptive paper key link:

https://drive.google.com/file/d/1XqtyrysMhl5jMuHhdKW2xcMYwk0CIRS2/view?usp=sharing

Objective Key Paper

I. Choose the correct alternative:

1) B) N/C
2) B) current
3) D) Simultaneous creation of equal and opposite charges is permissible
4) A) metre/volt
5) B) increases
6) B) -2
7) B) Point charges
8) B) Electrostatic potential = Work done/charge
9) C) Zero
10) D) Equipotential surface

Fill in the blanks:

1. $E = \int_L \frac{\rho dl}{4\pi\varepsilon R^2} a_R$

2. $\rho_V = \nabla . D$

3. $w_{e=\frac{D^2}{2\varepsilon}}$

4. A beam of electrons in a vacuum

5. $J=\sigma E$

6. $D=\varepsilon E$

7. Relaxation Time

8. $\nabla^2 V = \frac{\rho_v}{\varepsilon}$

9. $\nabla^2 V = 0$

10. Dielectric Constant

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SET-II

II-Mid Examinations, SEPTEMBER -2023

Year &Branch: II ECE A **Date: 11/09/2023**
Subject: EMF&W

ANSWER KEY

Descriptive paper key link:

https://drive.google.com/file/d/1mx3pC0i4JJAHqShcMl4RRaT7rGqLdk09/view?usp=sharing

Objective Key Paper

I. Choose the correct alternative:

1) B) An accelerated charge
2) C) Both E_x & E_y & in phase
3) C) Helmholtz
4) D) All of the above
5) D) microwaves
6) A) travel along the border walls of the waveguide
7) D) all
8) D) TE_{10}
9) B) E_y, B_z
10) A) E x H

II. Fill in the blanks:

1. $V=\frac{1}{\sqrt{\mu_0 \epsilon_0}}$
2. Transmission coefficient
3. Reflection coefficient
4. 120π
5. Group velocity
6. Propagation constant
7. Maxwell's equations
8. Transverse electromagnetic wave
9. 0.2rad/m
10. $tan^{-1}\sqrt{\frac{\epsilon_2}{\epsilon_1}}$

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SUBJECT: ELECTROMAGNETIC FIELDS AND WAVES

ASSIGNMENT- 1:

1.	State and Explain Coulomb's law?	(C222.1)	Remembering, Understanding
2.	Define electric field intensity and explain electric field intensity due to a surface charge distribution?	(C222.1)	Remembering, Understanding
3.	Define electric flux & flux density and explain flux density due to a line charge & surface charge?	(C222.1)	Remembering, Understanding
4.	State and explain Gauss's law with any one of the application?	(C222.2)	Remembering, Evaluating
5.	State and prove continuity equation, Relaxation time?	(C222.2)	Remembering, Analysis
6.	Explain Poisson's and Laplace equation?	(C222.3)	Understanding
7.	Define capacitance and derive the capacitance of coaxial capacitor & spherical capacitor?	(C222.3)	Remembering, Understanding and Analyzing

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SUBJECT: ELECTROMAGNETIC FIELDS AND WAVES

ASSIGNMENT- 2:

1.	State the boundary conditions in electrostatic fields and prove any one of them?	C222.3	Understanding, Applying
2.	State the Poynting theorem and derive necessary expressions?	C222.3	Remembering, Applying
3.	Derive wave equations for TM mode in rectangular wave guide?	C222.6	Applying
4.	State and Explain Biot- Savart law?	C222.2	Understanding Remembering,
5.	Describe the wave propagation in perfect dielectric, good dielectric and good conducting medium?	C222.4	Remembering

Course Title	ELECTROMAGNETIC FIELDS AND WAVES
Course Code	EC402PC
Programme	B.Tech
Year & Semester	II year II-semester
Regulation	R18
Course Faculty	K.RAJENDER, Assistant Professor, ECE

Slow learners:

S. No.	Roll no.	No of backlogs	Internal-I Status	Internal-II Status
1	21X31A0402	4	15	18
2	21X31A0403	4	15	19
3	21X31A0404	4	14	19
4	21X31A0407	5	16	21
5	21X31A0408	5	16	21
6	21X31A0409	5	15	15
7	21X31A0412	4	15	21
8	21X31A0414	5	15	22
9	21X31A0417	5	16	22
10	21X31A0422	5	18	20
11	21X31A0424	4	19	18
12	21X31A0425	4	20	20
13	21X31A0428	5	19	24
14	21X31A0433	5	19	21
15	21X31A0435	5	14	21
16	21X31A0436	4	14	14
17	22X35A0403	3	17	17

18	22X35A0404	3	14	17
19	22X35A0405	3	15	19
20	22X35A0408	5	16	17
21	22X35A0409	3	16	20
22	22X35A0419	3	20	23

Advanced learners:

S.No.	Roll no.	Gate Material
1	21X31A0401	**Maxwell's equations:** differential and integral forms and their interpretation, boundary conditions, wave equation, poynting vector. **Plane waves and properties:** reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth. **Transmission lines:** equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart. **Rectangular and circular waveguides:** light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.
2	21X31A0405	
3	21X31A0406	
4	21X31A0410	
5	21X31A0413	
6	21X31A0415	
7	21X31A0416	
8	21X31A0418	
9	21X31A0420	
10	21X31A0421	
11	21X31A0423	
12	21X31A0426	
13	21X31A0427	
14	21X31A0429	
15	21X31A0431	
16	21X31A0432	
17	21X31A0434	
18	21X31A0437	
19	22X35A0401	
20	22X35A0402	
21	22X35A0406	
22	22X35A0407	

23	22X35A0410	
24	22X35A0411	
25	22X35A0412	
26	22X35A0413	
27	22X35A0414	
28	22X35A0415	
29	22X35A0416	
30	22X35A0417	
31	22X35A0418	
32	22X35A0420	

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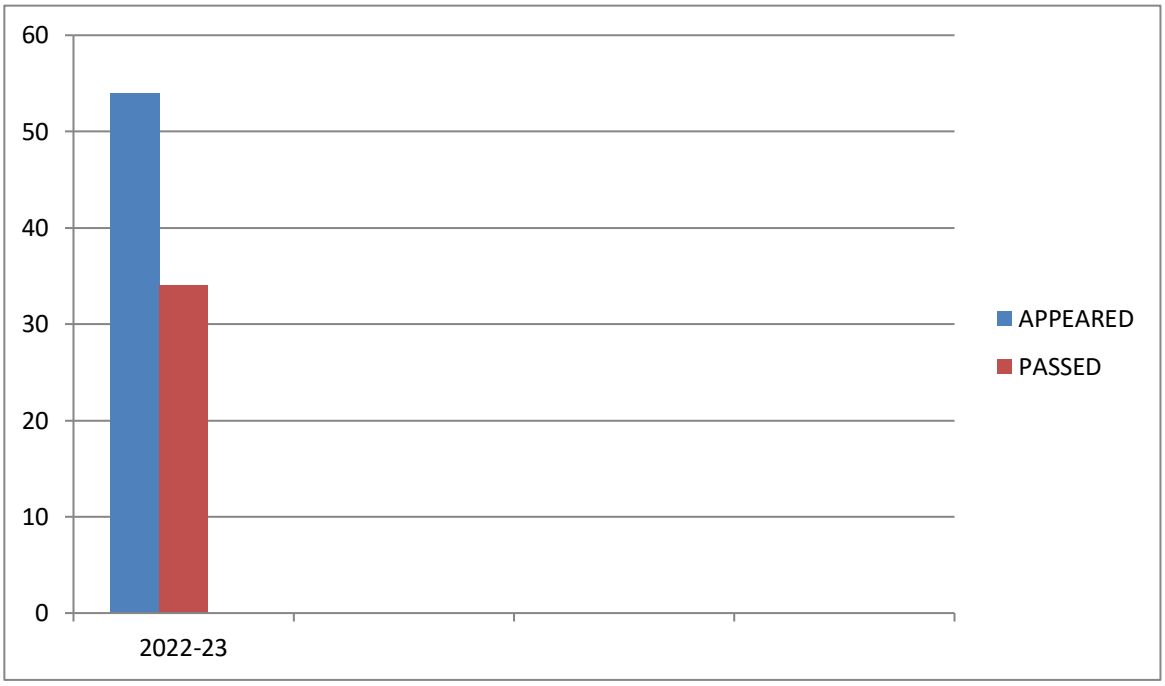
BATCH ECE-II BTECH II SEM ECE-A RESULT ANALYSIS

ACADAMIC YEAR	COURSE NAME	NUMBER OF STUDENTS		QUESTION PAPER SETTING		PASS%
		APPEARED	PASSED	INTERNAL	EXTERNAL	
2022-23	ELECTROMAGNETIC FIELDS AND WAVES	54	34	COURSE FACULTY	JNTUH	62.96%

ELECTROMAGNETIC FIELDS AND WAVES (C222) RESULTANALYSIS



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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

REMEDIAL CLASSES TIME TABLE

A.Y 2022-23 **SEMESTER-II**

BRANCH/ SEC	MON 4.00 PM- 5.00 PM	TUE 4.00 PM- 5.00 PM	WED 4.00 PM- 5.00 PM	THUR 4.00 PM- 5.00 PM	FRI 4.00 PM- 5.00 PM
II ECE-A	EMF&W	LTNM	A&DC	LICA	ECA
II ECE-B	LICA	A&DC	EMF&W	ECA	LTNM
III ECE-A	DSP	VLSID	A&P	ESD	IM
III ECE-B	A&P	ESD	DSP	IM	VLSID
III ECE-C	IM	A&P	ESD	VLSID	DSP
IV ECE-A	WSN	ML	LPVLSID	-	-
IV ECE-B	ML	LPVLSID	WSN	-	-
IV ECE-C	LPVLSID	WSN	ML	-	-

HOD
Head of the Department
Electronics and Communication Engg. Dept
SRI INDU INSTITUTE OF ENGG & TECH
Sheriguda(V), Ibrahimpatnam(M), R.R.Dist-501 510.

PRINCIPAL
PRINCIPAL
Sri Indu Institute of Engineering & Tech
Sheriguda(Vill), Ibrahimpatnam
R R Dist Telangana -501 510

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Course Outcome Attainment (Internal Examination-1)

Name of the faculty : K.RAJENDER Academic Year: 2022-23

Branch & Section: ECE - A Examination: I Internal

Course Name: EMF&W Year: II Semester: II

S.No	HT No.	Q1a	Q1b	Q2a	Q2b	Q3a	Q3b	Q4a	Q4b	Obj1	A1
Max. Marks ==>		5		5		5		5		10	5
1	21X31A0401	5								4	5
2	21X31A0402	4								6	5
3	21X31A0403	5								5	5
4	21X31A0404	4								5	5
5	21X31A0405	5				3				7	5
6	21X31A0406	5								8	5
7	21X31A0407	5								6	5
8	21X31A0408	5								6	5
9	21X31A0409	5								5	5
10	21X31A0410	5								5	5
11	21X31A0412	4								6	5
12	21X31A0413	4								6	5
13	21X31A0414	5								5	5
14	21X31A0415	4								5	5
15	21X31A0416	3								7	5
16	21X31A0417	3								8	5
17	21X31A0418	5		4						7	5
18	21X31A0420	5		4						9	5
19	21X31A0421	5								8	5
20	21X31A0422	5								8	5
21	21X31A0423	5								7	5
22	21X31A0424	5		2						7	5
23	21X31A0425	5				3				7	5
24	21X31A0426	4								8	5
25	21X31A0427	4				3				6	5
26	21X31A0428	5		1						8	5
27	21X31A0429	4						2		7	5
28	21X31A0431	5		3						6	5
29	21X31A0432	4						2		8	5
30	21X31A0433	4		3						7	5
31	21X31A0434	3								6	5
32	21X31A0435	3								6	5
33	21X31A0436			0						9	5
34	21X31A0437			3						6	5
35	22X35A0401	5								6	5
36	22X35A0402	5						3		6	5
37	22X35A0403	5		2						5	5
38	22X35A0404	4								5	5
39	22X35A0405	3								7	5
40	22X35A0406	4								7	5
41	22X35A0407	4						3		7	5
42	22X35A0408	5								6	5
43	22X35A0409	5								6	5

44	22X35A0410	5						3		6	5
45	22X35A0411	4		5						5	5
46	22X35A0412	5								4	5
47	22X35A0413	5		5						6	5
48	22X35A0414	5		4						6	5
49	22X35A0415	4								8	5
50	22X35A0416	5		5						8	5
51	22X35A0417	5		3						7	5
52	22X35A0418	5		3						8	5
53	22X35A0419	5		2						8	5
54	22X35A0420	5						3		9	5
Target set by the faculty / HoD		3.00	0.00	3.00	0.00	3.00	0.00	3.00	0.00	6.00	3.00
Number of students performed above the target		52	0	12	0	3	0	4	0	43	54
Number of students attempted		52	0	17	0	3	0	6	0	54	54
Percentage of students scored more than target		100%		71%		100%		67%		80%	100%

CO Mapping with Exam Questions:

CO - 1	Y		Y				Y		Y	Y
CO - 2					Y				Y	Y
CO - 3									Y	Y
CO - 4										
CO - 5										
CO - 6										

% Students Scored >Target %	100%		71%		100%		67%		80%	100%

CO Attainment based on Exam Questions:

CO - 1	100%		71%				67%		80%	100%
CO - 2					100%				80%	100%
CO - 3									80%	100%
CO - 4										
CO - 5										
CO - 6										

CO	Subj	obj	Asgn	Overall	Level
CO-1	79%	80%	100%	86%	3.00
CO-2	100%	80%	100%	93%	3.00
CO-3		80%	100%	90%	3.00
CO-4					
CO-5					
CO-6					

Attainment Level	
1	40%
2	50%
3	60%

Attainment (Internal 1 Examination) = **3.00**

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Course Outcome Attainment (Internal Examination-2)

Name of the faculty : K.RAJENDER Academic Year: 2022-23

Branch & Section: ECE-A Examination: II Internal

Course Name: EMF&W Year: II Semester: II

S.No	HT No.	Q1a	Q1b	Q2a	Q2b	Q3a	Q3b	Q4a	Q4b	Obj2	A2
Max. Marks ==>		5		5		5		5		10	5
1	21X31A0401	3		4						6	5
2	21X31A0402							5		8	5
3	21X31A0403							5		9	5
4	21X31A0404					1		5		8	5
5	21X31A0405					3		5		8	5
6	21X31A0406			5				4		10	5
7	21X31A0407	3		4						9	5
8	21X31A0408	4		4						8	5
9	21X31A0409					2				8	5
10	21X31A0410			5				5		9	5
11	21X31A0412			5				2		9	5
12	21X31A0413			5				4		9	5
13	21X31A0414			4				5		8	5
14	21X31A0415	4		3						9	5
15	21X31A0416					3		4		8	5
16	21X31A0417	5						3		9	5
17	21X31A0418	4						5		10	5
18	21X31A0420			5				5		9	5
19	21X31A0421	5		2						10	5
20	21X31A0422	4				2				9	5
21	21X31A0423	5		5						8	5
22	21X31A0424	5								8	5
23	21X31A0425	4		3						8	5
24	21X31A0426	4						5		9	5
25	21X31A0427			5				4		10	5
26	21X31A0428			5				5		9	5
27	21X31A0429			5				5		9	5
28	21X31A0431	3						4		9	5
29	21X31A0432	4		3						9	5
30	21X31A0433	3		4						9	5
31	21X31A0434					4		4		7	5
32	21X31A0435					4		3		9	5
33	21X31A0436									9	5
34	21X31A0437					3		5		6	5
35	22X35A0401	5				3				8	5
36	22X35A0402	5				3				8	5
37	22X35A0403	5								7	5
38	22X35A0404					4				8	5
39	22X35A0405	3				2				9	5
40	22X35A0406	3				4				9	5
41	22X35A0407	4				3				9	5
42	22X35A0408	4		2						6	5
43	22X35A0409	4		4						7	5
44	22X35A0410	5		4						7	5
45	22X35A0411	4				4				5	5
46	22X35A0412	4				5				6	5
47	22X35A0413	5		4						4	5

48	22X35A0414	3				4				8	5
49	22X35A0415	4						5		10	5
50	22X35A0416	4						5		10	5
51	22X35A0417	5		4						9	5
52	22X35A0418			5						10	5
53	22X35A0419			4		4				10	5
54	22X35A0420	5				4				10	5
Target set by the faculty / HoD		3.00	0.00	3.00	0.00	3.00	0.00	3.00	0.00	6.00	3.00
Number of students performed above the target		32	0	23	0	15	0	22	0	52	54
Number of students attempted		32	0	25	0	20	0	23	0	54	54
Percentage of students scored more than target		100%		92%		75%		96%		96%	100%

CO Mapping with Exam Questions:

CO - 1										
CO - 2										
CO - 3		Y							Y	Y
CO - 4	Y								Y	Y
CO - 5			Y						Y	Y
CO - 6					Y		Y		Y	Y

% Students Scored >Target %	100%		92%		75%		96%		96%	100%

CO Attainment based on Exam Questions:

CO - 1										
CO - 2										
CO - 3									96%	100%
CO - 4	100%								96%	100%
CO - 5			92%						96%	100%
CO - 6					75%		96%		96%	100%

CO	**Subj**	obj	Asgn	Overall	Level
CO-1					
CO-2					
CO-3		96%	100%	98%	3.00
CO-4	100%	96%	100%	99%	3.00
CO-5	92%	96%	100%	96%	3.00
CO-6	85%	96%	100%	94%	3.00

Attainment Level	
1	40%
2	50%
3	60%

Attainment (Internal Examination-2) = **3.00**

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Course Outcome Attainment (University Examinations)

Name of the faculty : K.RAJENDER Academic Year: 2022-23

Branch & Section: ECE - A Year / Semester: II / II

Course Name: EMF&W

S.No	Roll Number	Marks Secured
1	21X31A0401	32
2	21X31A0402	40
3	21X31A0403	6
4	21X31A0404	34
5	21X31A0405	26
6	21X31A0406	30
7	21X31A0407	9
8	21X31A0408	1
9	21X31A0409	1
10	21X31A0410	33
11	21X31A0412	17
12	21X31A0413	33
13	21X31A0414	2
14	21X31A0415	32
15	21X31A0416	26
16	21X31A0417	16
17	21X31A0418	30
18	21X31A0420	37
19	21X31A0421	26
20	21X31A0422	26
21	21X31A0423	31
22	21X31A0424	35
23	21X31A0425	14
24	21X31A0426	26
25	21X31A0427	43
26	21X31A0428	10
27	21X31A0429	26
28	21X31A0431	26
29	21X31A0432	17
30	21X31A0433	1
31	21X31A0434	32
32	21X31A0435	1
33	21X31A0436	29
34	21X31A0437	30
35	22X35A0401	29
Max Marks		75

S.No	Roll Number	Marks Secured
36	22X35A0402	26
37	22X35A0403	26
38	22X35A0404	8
39	22X35A0405	7
40	22X35A0406	11
41	22X35A0407	16
42	22X35A0408	3
43	22X35A0409	17
44	22X35A0410	39
45	22X35A0411	31
46	22X35A0412	27
47	22X35A0413	26
48	22X35A0414	26
49	22X35A0415	0
50	22X35A0416	33
51	22X35A0417	26
52	22X35A0418	28
53	22X35A0419	5
54	22X35A0420	34

Class Average mark	22
Number of students performed above the target	34
Number of successful students	54
Percentage of students scored more than target	63%
Attainment level	**3**

Attainment Level	% students
1	40%
2	50%
3	60%

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Course Outcome Attainment

Name of the faculty K.RAJENDER
Branch & Section: ECE - A
Course Name: EMF&W

Academic Year: 2022-23
Examination: I Internal
Year: II
Semester: II

Course Outcomes	1st Internal Exam	2nd Internal Exam	Internal Exam	University Exam	Attainment Level
CO1	3.00		3.00	3.00	3.00
CO2	3.00		3.00	3.00	3.00
CO3	3.00	3.00	3.00	3.00	3.00
CO4		3.00	3.00	3.00	3.00
CO5		3.00	3.00	3.00	3.00
CO6		3.00	3.00	3.00	3.00
Internal & University Attainment:			3.00	3.00	
Weightage			25%	75%	
O Attainment for the course (Internal, Universi			0.75	2.25	
CO Attainment for the course (Direct Method)			3.00		

Overall course attainment level **3.00**

SRI INDU INSTITUTE OF ENGINEERING & TECHNOLOGY

Department of Electronics and Communication Engineering

Program Outcome Attainment (from Course)

Name of Faculty: K.RAJENDER
Academic Year: 2022-23
Branch & Section: ECE - A
Year: II
Course Name: EMF&W
Semester: II

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	1	1	1	2	-	3	1	2
CO2	3	2	2	2	-	-	1	1	-	2	-	2	1	2
CO3	3	2	2	-	-	-	1	1	-	2	-	3	2	1
CO4	3	1	1	-	-	1	1	1	-	2	-	3	1	2
CO5	2	3	2	1	-	-	1	1	-	2	2	2	2	1
CO6	2	2	1	-	2	1	1	1	1	2	-	3	2	2
Course	**2.67**	**2.00**	**1.60**	**1.50**	**2.00**	**1.00**	**1.00**	**1.00**	**1.00**	**2.00**	**2.00**	**2.67**	**1.50**	**1.67**

CO	**Course Outcome Attainment**
CO1	3.00
CO2	3.00
CO3	3.00
CO4	3.00
CO5	3.00
CO6	3.00
Overall course attainment level	**3.00**

PO-ATTAINMENT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO Attainment	**2.67**	**2.00**	**1.60**	**1.50**	**2.00**	**1.00**	**1.00**	**1.00**	**1.00**	**2.00**	**2.00**	**2.67**	**1.50**	**1.67**

CO contribution to PO - 33%, 67%, 100% (Level 1/2/3)

ASSIGNMENTS AND REGISTERS

Assignment 1 script link:

https://drive.google.com/file/d/1zmJM5XR31Xyrvp3FmT4JA4xyYj249qak/view?usp=sharing

Assignment 2 script link:

https://drive.google.com/file/d/1ECepgZjk_c8s8AX1Zz0eE9OP9QqnTq62/view?usp=sharing

Attendance register link:

https://drive.google.com/file/d/1ZDZ4rKUxj6m4QyC9Ixoe9j1A_E4WLVcd/view?usp=sharing