FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication)**

Semester: **V**

Course Code: **202060503**

Course Title: **Electromagnetic and Wave Propagation**

Course Group: **Professional Core Course**

Course Objectives: This course provides strong foundation for understanding the fundamental principles and laws of electromagnetism. Further, this course helps students to understand transmission, radiation and propagation of electromagnetic wave theory. Students can also understand the physical interpretation and application of various laws and theorems of electric and magnetic fields. In addition to that, a concept of the transmission lines, antennas and waveguides theory are covered to elaborate the advanced domain.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	2	0	4	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hour s
1	**Vector Analysis & Coordinate Systems:** Vector Algebra, Transformation of Coordinate system, Line, surface and volume integrals, Coulomb's Law and concept of Electric Field, Divergence, Gradient and Curl	7
2	**Electrostatic fields:** Coulomb's Law and concept of Electric Field, Line, Surface and Volume Charge Distributions, Gauss law, Divergence Theorem, Concept of Electrostatic Potential, Laplace and Poisson equations, Capacitance, Dielectric boundary conditions.	7
3	**Magnetostatic fields:** Biot-Savart and Ampere's laws and its applications, Stokes's Theorem, Inductance calculation, Faraday's law, Lorentz Equation, Magnetic Scalar and Vector Potentials, Magnetic materials, Magnetic Boundary conditions	8

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4	**Maxwell equations and uniform plane waves:** Displacement Current, Maxwell's Equations in differential Form and in Integral Form, Wave propagation in free space, dielectrics and conductors, skin effect, Power and Poynting vector.	**8**
5	**Transmission lines:** Transmission lines parameters and its equation, Lossless and Distortion less Transmission Lines, Reflection coefficient, Transmission Coefficient, Propagation constant, Standing wave ratio	**7**
6	**Antenna Fundamentals and Waveguides:** Definitions of Antenna and its types, Directivity and gain, Antenna aperture, Radiation resistance, Radiation Pattern, Antenna field zones, Frill's formula, Antenna array: Yagi uda antenna, Helix antenna, Log periodic antenna, Micro-strip patch antenna.	**8**
		45

List of Practicals / Tutorials:

1	Tutorial 1: Vector Algebra
2	Tutorial 2: Electric Field Intensity & Flux density, Potential
3	Tutorial 3: Magnetic Field Intensity & Flux density
4	Tutorial 4: Electric & Magnetic Boundary conditions
5	Tutorial 5: Wave propagation in different medium
6	Tutorial 6: Antenna & waveguide parameters
7	MATLAB Simulation for Electromagnetic Wave radiation and propagation.
8	Introduction to NEC 2 CST/ADS software.
9	Impedance Matching using Smith Chart
10	Open Ended Problem

Reference Books:

1	M. N. O. Sadiku, S V Kulkarni, **Principles of Electromagnetics**, 6th Edition, Oxford University Publication.
2	W. Hayt, **Engineering Electromagnetics**, 7th Edition, McGraw Hill Education.
3	Samuel Liao, **Microwave Devices and Circuits**, 3rd Edition, Prentice Hall India.
4	A. Pramanik, **Electromagnetism-Problems with Solution**, Prentice Hall India, 2012.
5	John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan, **Antennas and Wave Propagation**, 5th Edition, McGraw Hill.

Supplementary learning Material:	
1	NPTEL and Coursera Video lectures.
2	MIT Course materials.

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits

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- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
15	40	10	15	10	10	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the physical interpretation of coulomb's law, Gausses law, Biot Savart law, Amperes Circuital law and application of divergence, curl and gradient.	**25**
CO-2	Analyze the electromagnetic waves using Maxwell's equations, Poisson's and Laplace equations	**25**
CO-3	Describe and analyze electromagnetic wave propagation in free-space, dielectrics and conductors.	**25**
CO-4	Design, analyze and test the capacitor, co-axial cable, waveguide and antennas.	**25**

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June -2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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