	National Institute of Technology Meghalaya An Institute of National Importance	CURRICULUM

Programme	M.Tech/Ph.D	Year of Regulation	2020-21
Department	Electronics and Communication Engineering	Semester	II

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 562	ADVANCED ENGINEERING ELECTROMAGNETICS	3	0	0	3	50	50	100	200

Course Objectives	Course Outcomes	
To introduce the idea of Differential and integral Form of Maxwell equation, Boundary Conditions, types of Electromagnetic Fields.	CO1	Able to develop knowledge about differential and integral Form of Maxwell equation, Boundary Conditions, electromagnetic fields.
To teach the fundamental concept of different types of wave equations and its solution.	CO2	Able to analyze different types of wave equations and its solution.
To teach the idea of fundamental concept of electromagnetic Wave Propagation and their Polarization.	CO3	Able to understand the concepts of electromagnetic Wave Propagation and their Polarization.
To introduce the idea of Reflection and Transmission characteristics along with Classification of Materials.	CO4	Able to analyze reflection and transmission characteristics as well as Materials characteristics.
To teach some concept about the Vector Potentials, Radiation and Scattering Equations of near field and far field.	CO5	Able to understand the principle of the Vector Potentials, Radiation and Scattering Equations of near field and far field of EM waves.
	CO6	

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	CO1												1	3	2	2	0
2	CO2												1	3	2	2	0
3	CO3												1	3	2	2	0
4	CO4												1	3	2	2	0
5	CO5												1	2	3	3	0
6	CO6												0	0	0	0	0

SYLLABUS

No.	Content	Hours	COs
I	**Introduction** Time-Varying and Time-Harmonic Electromagnetic Fields, Differential and integral Form of Maxwell's Equations, Circuit-Field Relations, Boundary Conditions; Sources Along Boundaries, Power and Energy.	05	CO1
II	**Wave Equation and its Solutions** Time-Varying Electromagnetic Fields, Time-Harmonic Electromagnetic Fields, Solution to the Wave Equation; Rectangular Coordinate System, Cylindrical Coordinate System, Spherical Coordinate System.	07	CO2
III	Wave Propagation and Polarization Introduction, Transverse Electromagnetic Modes; Uniform Plane Waves in an Unbounded Lossless Medium—Principal Axis, Uniform Plane Waves in an Unbounded Lossless Medium—Oblique Angle, Transverse Electromagnetic Modes in Lossy media, Polarization; Linear Polarization, Circular Polarization, Elliptical Polarization, Poincare´ e Sphere.	08	CO3
IV	Reflection and Transmission Normal Incidence—Lossless Media, Oblique Incidence—Lossless Media; Perpendicular Polarization, Parallel Polarization, Total Transmission–Brewster Angle, Total Reflection–Critical Angle, Lossy Media; Normal Incidence, Oblique Incidence, Reflection and Transmission of Multiple Interfaces, Polarization Characteristics on Reflection, Metamaterials; Classification of Materials, Double Negative (DNG) Materials, Negative-Refractive-Index (NRI) Transmission Lines.	08	CO4
V	Auxiliary Vector Potentials, Construction of Solutions, and Radiation and Scattering Equations Introduction, The Vector Potential A, The Vector Potential F, The Vector Potential A and F, Construction of Solutions; Transverse Electromagnetic Modes: Source-Free Region, Transverse Magnetic Modes: Source-Free Region, Transverse Electric Modes: Source-Free Region, Solution of the Inhomogeneous Vector Potential Wave Equation, Far-Field Radiation, Radiation and Scattering Equations; Near Field, Far Field.	08	CO5
	Total Hours	36	

Essential Readings

1. C. A. Balanis, "Advanced Engineering Electromagnetics", John Wiley & Sons, 2nd Edition, 2012
2. Jordan and Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall India Learning Private Limited; 2nd Editions, 2015
3. W.Hayt, J. Buck and Akhtar, "Engineering Electromagnetics", McGraw Hill Education; 8th Edition,2001

Supplementary Readings

1. C. Caloz and T. Itoh, "Electromagnetic Metamaterials: Transmission Line Theory and Microwave Applications", JohnWiley & Sons, 1st Edition, 2005
2. B. A. Munk," Frequency Selective Surfaces: Theory and Design", John Wiley & Sons, 1st Edition, 2000
3. D. H. Werner and D-H Kwon, "Transformation Electromagnetics and Metamaterials: Fundamental Principles and Applications", Springer, 1st Edition, 2014