

# International Summer School -Manipal University Jaipur [ISSMUJ]-2024



[Hybrid Mode]

## Course Overview

### Name of Course- 5G and Microstrip Antenna Technology

Name of Instructor: Dr. Amit Rathi

Session: June-July 2024

Language of instruction: English

Number of contact hours: 36

Credit awarded: 03

Pre-requisite: Basic knowledge of Electromagnetic Waves.

Intended Audience: All undergraduate and postgraduate students, PhD scholars, teachers, and industry.

### Objective of Course/Project

1. Understand measurement of antenna parameters and application of basic theorems in analyzing radiation characteristics of the antenna
2. Gain the base-level knowledge of 5G you need to continue your wireless education and advance in the rapidly growing field of wireless technology.
3. Provide a physical and mathematical basis for understanding how microstrip antennas work.
4. Design and implement antennas using EM simulation tools.

### Syllabus:

**There are 4 modules in this course.**

#### **Module 1- “Antenna Terminology”**

Basic antenna parameters, Thevenin Equivalent of Transmitter Antenna, patterns, isotropic antenna, Beam Area or Beam Solid Angle Gain, Radiation Density, Radiation Density, Power Gain, Antenna Efficiency Factor, Input Impedance, Radiation Resistance, Image Antenna Directivity, lobes, polarizations, Field regions.

#### **Module 2- “5 G Technology”**

Wireless, 1G to 5G wireless frequencies, why 4G is not enough, Core for 5G, Back Bone, Cones, Need of Microstrip Antennas in 5G

#### **Module 3- “Microstrip Antenna Technology”**

Overview of Microstrip Antennas, History of Microstrip Antennas, Why we use MSA, Typical Applications, Geometry of Rectangular Patch, Advantages & Disadvantages of Microstrip Antennas, Basic Principles and Thin Substrate Approximation, Magnetic Wall Approximation, Basic Properties of Microstrip Antennas, Substrates, Optimizing the Substrate Properties for Increased Bandwidth, Approximate CAD Model for Zin,

Circular Polarization, Feeding Methods, Comparing the different feed techniques, Improving Bandwidth, Multi-Band Antennas, Miniaturization, Improving Performance, RMSA: Design Equations and example, Effect of Various Parameters on Performance of RMSA, CMSA: Resonance Frequency.

#### Module 4- “Experiments”

1. To become familiar with the microstrip antenna.
2. To study the different antenna parameters.
3. Design and simulation of microstrip antenna using CST tool.

#### Organization of Course

Total contact Hours: 36		
1st week:	6-hrs (classes)	2-hrs (self-study/project)
2nd week:	6-hrs (classes)	2-hrs (Mid-term exam/assessment/discussion)
3rd week:	6-hrs (classes)	5-hrs (self-study/project)
4 <sup>th</sup> week:	6-hrs (Classes)	3-hrs (End term exam)


**Mode of lectures:** Hybrid mode lecture

#### Course/Project Plan

Lecture no.	Topic	Lecture mode	Instructor
L: 1-4	Basic antenna parameters, Thevenin Equivalent of Transmitter Antenna, patterns, isotropic antenna, Beam Area or Beam Solid Angle Gain, Radiation Density, Radiation Density, Power Gain, Antenna Efficiency Factor, Input Impedance, Radiation Resistance, Image Antenna Directivity, lobes,	Hybrid	Dr. Amit Rathi
L: 5-6	self-study		
L: 7-10	Wireless, 1G to 5G wireless frequencies, why 4G is not enough, Core for 5G, Back Bone, Cones, Need of Microstrip Antennas in 5G	Hybrid	Dr. Amit Rathi
L: 11-14	Overview of Microstrip Antennas, History of Microstrip Antennas, Why we use MSA, Typical Applications, Geometry of Rectangular Patch, Advantages & Disadvantages of Microstrip Antennas, Basic Principles and Thin Substrate Approximation, Magnetic Wall Approximation, Basic Properties of Microstrip Antennas, Substrates, Optimizing the Substrate Properties for Increased Bandwidth, Approximate CAD	Hybrid	Dr. Amit Rathi

	Model for Zin, Circular Polarization, Feeding Methods, Comparing the different feed techniques,		
L: 15-16	Mid-term exam		
L: 17-20	Improving Bandwidth, Multi-Band Antennas, Miniaturization, Improving Performance , RMSA: Design Equations and example, Effect of Various Parameters on Performance of RMSA, CMSA: Resonance Frequency.	Hybrid	Dr. Amit Rathi
L: 21	To become familiar with the microstrip antenna.	Hybrid	Dr. Amit Rathi
L: 22	To study the different antenna parameters.	Hybrid	Dr. Amit Rathi
L:23-32	Design and simulation of microstrip antenna using CST tool.	Hybrid	Dr. Amit Rathi
L:33-36	End term exam		

### Brief profile of the instructor with Photograph

1.	Department	MUJ/FOE/SEECECE	
2.	Title (Mr./ Mrs. Miss/Dr./ Prof.)	Prof	
3.	Name	Amit Rathi	
4.	Designation	Professor	
5.	UG Degree	Bachelor of Engineering (ETE)	
6.	UG University	College of Engineering, Osmanabad	
7.	PG Degree	M.Tech (ECE)	
8.	PG University	MNIT, Jaipur	
9.	Ph.D (Yes/ No/ Pursuing)	Yes	