Course Code	ECE431 / ECE631
Course Name	Antennas Theory and Design
Credits	4
Course Offered to	UG/PG
Course Description	The course aims to introduce the principles of antenna theory and design as well as wave propagation to senior undergraduate and graduate students who have a background in fundamental electromagnetics. The course will enable the students to understand the operation of common antennas and provide them an opportunity to design and test antennas. Thus the course will combine both the theoretical and practical aspects of antenna design. This course may be useful to students interested in implementing wireless systems (communications and radar).

Pre-requisites		
Pre-requisite (Mandatory)	Pre-requisite (Desirable)	Pre-requisite(other)
ECE230 Fields and Waves		
*Please insert more rows if required		

Post Conditions*(For suggestions on verbs please refer the second sheet)			
CO1	CO2	CO3	CO4
Students are able to analyze Maxwell's equations for wave propagation through different mediums (free space, lossy, dispersive).	Students are able to design and/or analyze wire, loop, aperture, active and broadband antennas in theory and/ or using computational electromagnetic software	Students are able to extend the analysis and design from a single antenna to an antenna array	Students are able to measure (in simulations and/or experiments) the basic parameters of common antennas

Weekly Lecture Plan			
Week Number	Lecture Topic	COs Met	Assignment/Labs/Tutorial
1	Introduction - Review of vector calculus, review of Maxwells equations, Materials and free space, Wave propagation	C01	Assignment
2	Why do antennas radiate? - Vector potential A for electric current source, vector potential F for magnetic current source, solution of inhomogeneous Helmholtz equation, far field radiation	C01	Assignment
3, 4	Radiation pattern, beamwidth, directivity, antenna efficiency and gain, bandwidth, input impedance, polarization, antenna effective length and effective area, Friis transmission equation	C04	Assignment / Lab / Tutorial
5	Infinitesimal, small and half wavelength dipoles, effect of conductors near ground planes, monopoles, loop antennas	C02	Assignment / Lab / Tutorial
6,7	Antenna arrays - Two element array, N element array, planar array and adaptive beamforming	C03	Assignment / lab

8	Aperture antennas - rectangular aperture, slot antennas and arrays	C02	Assignment
9	Microstrip antennas - rectangular patch, linear and circular polarization, bandwidth, efficiency	C02	Assignment / lab
10	Broadband antennas - Chu's limit, Yagi antenna, helical antenna	C02	Lab
11	New antennas - active antennas, wearable antennas	C02	Tutorial
12,13	Project	C02,C04	

*Please insert more rows if required

Weekly Lab Plan

Week Number	Laboratory Exercise	COs Met	Platform (Hardware/Software)
3,4	Learn to use vector network analyzer to measure bandwidth	C04	Agilent Field Fox VNA
6,7	Use software to measure antenna parameters	C04	CST / HFSS
Project - 6 - 13	Use software to design antenna and hardware to test antenna performance	C02, C04	CST / HFSS + VNA

*Please insert more rows if required

Assessment Plan

Type of Evaluation	% Contribution in Grade
Homework	15
Quiz	10
Mid-sem	25
End-sem	30
Project	20

*Please insert more row for other type of Evaluation

Resource Material

Type	Title
Textbook	Antennas Theory Analysis and Design, 3rd Edition, Constantine Balanis
Reference	Antennas and Wave propagation, J. D. Kraus