Course Code	ECE543
Course Name	Principles of Digital Communications
Credits	4
Course Offered to	UG/PG
Course Description	Optimal receiver designs for digital communications using statistical communication theory principle, Using Signal Space concepts for optimum receiver design, Multiple access systems like CDMA and OFDM, Using MIMO to achieve Receive &Transmit Diversity and multiplexing gains

Pre-requisites		
Pre-requisite (Mandatory)	Pre-requisite (Desirable)	Pre-requisite(other)
ECE240 Principles of Communication Systems	ECE501 Probability and Random Processes	

*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 estimate limits on maximum rate at which reliable communication can take place over a noisy channel	Students are able to develop optimal receiver designs for digital communications using statistical communication theory principles and equivalent and equivalent signal sets.	Students are able to analyze different multiple access techniques (CDMA and OFDM) on the basis of detectability, bandwidth and complexity of implementation	Students are able to use MIMO principles to achieve Receive & Transmit Diversity and multiplexing gains

Weekly Lecture Plan			
Week Number	**Lecture Topic**	**COs Met**	**Assignment/Labs/Tutorial**
Week 1,2,3	• Uncertainty, Information and Entropy • Discrete Memoryless Channel • Mutual Information for continuous ensemble • Channel Capacity Theorem	CO1	End of chapter problems from the text
Week 4,5,6,7	• Vector channel: Decision regions, Additive Gaussian Noise, Multi vector channel • Waveform Channel: Geometric Interpretation of signals, Recovery of Signal Vectors • Receiver Implementation: Correlation receiver, Matched filter receiver • Probability of Error: Equivalent signal sets, Union bound on probability of error • Efficient signaling for message sequences: Block Orthogonal signaling – Geometric interpretation, Signaling selection – Binary and multi-level	CO2	End of chapter problems from the text
Week 8,9,10	CDMA Introduction to CDMAVariable tree OVSF, PN Sequences , Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization OFDM Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issue	CO3	End of chapter problems from the text

Week 11,12,13	• Introduction to MIMO • MIMO Channel Capacity • SVD and Eigen-modes of the MIMO Channel • MIMO Spatial Multiplexing – BLAST • MIMO Diversity – Alamouti, OSTBC, MRT	CO4	End of chapter problems from the text

*Please insert more rows if required

Weekly Lab Plan			
Week Number	**Laboratory Exercise**	**COs Met**	**Platform (Hardware/Software)**
Course does not have a lab component			

*Please insert more rows if required

Assessment Plan

Type of Evaluation	% Contribution in Grade
Assignment	**10**
Mid-sem	**25**
Paper presentation	**5**
Project	**10**
End-sem	**50**

*Please insert more row for other type of Evaluation

Resource Material	
Type	**Title**
Reference	J. Wozencraft & I. Jacobs, “Principles of Communication Engineering” John Wiley.
Reference	2. R. G. Gallager, ``Principles of Digital Communications” Cambridge Univ. Press. 2008.
Reference	3. J. G. Proakis & M. Salehi, ``Digital Communications” McGraw Hill, 5th Ed.
Reference	4. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communications”, Cambridge University Press. 5. Andrea Goldsmith, “Wireless Communications” Cambridge University Press.
Reference	6. Theodore Rappaport, “Wireless Communications: Principles and Practice” Prentice Hall.
Reference	7. Modern Wireless Communications.....Aditya Jaganathan, IIT Kanpur