



FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Engineering

Semester I

Course Code: 102430110

Course Title: Modern Digital and Wireless Communication

Type of Course: Programme Elective-II

Course Objectives: To understand modern digital and wireless communication systems. To learn various efficient techniques CDMA, MIMO and OFDM involve in advance communication systems. To have insights of recent advancements in wireless communication systems.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorials	Practicals		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	30 / 15	20 / 10	70 / 35	30 / 15	150 / 75

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

Detailed Syllabus:

Sr.	Contents	Hours
1	Basics of Digital Communication Systems: Gaussian random Variable, BER performance of communication System in an AWGN Channel, SER and BER for QPSK in AWGN, BER for M-ary PAM, SER for M-QAM, BER for M-ary PSK, Binary signal vector detection problem	05
2	Principles of Wireless Communication: The wireless communication environment, modelling of wireless systems, system model for narrowband signals, Rayleigh fading wireless channel, BER performance of wireless systems, channel estimation in wireless systems, Diversity in wireless communication, multiple antenna receive model, BER in multiple antenna system, channel estimation in multiple antenna system, diversity order, basics of wireless channel modelling, maximum delay spread, rms delay spread, average delay spread and coherence bandwidth in wireless communication, relation between ISI and coherence bandwidth, Doppler fading in wireless systems, Doppler impact on wireless channel, coherence time of wireless channel and its implications.	14
3	Code Division Multiple Access: Fundamentals of CDMA codes, Spreading codes based on Pseudo-Noise sequences, correlation properties of random CDMA spread sequences, Multi-user CDMA, Advantages of CDMA, CDMA near far problem and power control, Performance of CDMA downlink scenario with multiple users, Performance of CDMA uplink scenario with multiple users, Asynchronous CDMA	05
4	Multiple Input Multiple Output Wireless Communications: Introduction to MIMO wireless Communications, MIMO System model, MIMO zero forcing (ZF) receiver, MIMO MMSE receiver, Singular Value Decomposition (SVD) of the MIMO channel,	10



	MIMO capacity, Asymptotic MIMO capacity, Alamouti and space time codes, Non linear MIMO receiver, MIMO beamforming. Issues related to plagiarism, collaborative models and ethics, acknowledgements. Intellectual Property Rights: copy rights, copy left: patents, Industrial designs, Trademarks.	
5	Orthogonal Frequency Division Multiplexing: Introduction to OFDM, multicarrier transmission, cyclic prefix in OFDM, BER for OFDM, MIMO-OFDM, effect of frequency offset in OFDM, Peak to Average Power ratio in OFDM, SC-FDMA.	05
6	Recent advancements in wireless technology: Introduction to 4G LTE, VoLTE, 5G Technology, NOMA and Massive MIMO.	03

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

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
15%	40%	10%	15%	15%	5%	

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.

Reference Books:

1	Aditya K. Jagannatham, "Principle of Modern Wireless Communication Systems: Theory and practice" 1st Edition, McGrawHill Publication
2	Theodore S. Rappaport, "Wireless Communications: Principles and Practice" Second Edition, Pearson Education
3	Simon Haykin, Michale Moher, "Modern Wireless Communications", Pearson.
4	Xiaodong Wang, H. Vincent Poor, "Wireless Communication Systems: Advanced Techniques for Signal Reception", Pearson
5	Proakis J.J., D Wozencraft J.M. and Jacobs I.M., Principles of Communication Engineering, John Wiley

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand BER performance of various digital modulation techniques	5
CO-2	Learn how to model wireless communication system	10
CO-3	Learn how to measure the performance of wireless system, in multipath environment	10
CO-4	Understand channel estimation techniques and Doppler effect	10
CO-5	Learn Principle and properties of CDMA uplink, downlink.	15
CO-6	Learn working and advantages of MIMO wireless communication systems	25
CO-7	Understand the principle and advantages of OFDM system	15
CO-8	Understanding of various modern wireless communication technologies	10

List of Practical / Tutorials:

Laboratory work will be based on applications of the above syllabus with minimum 10 Experiments to be incorporated.

1	To study and analysis of various Digital modulation techniques
2	To study and analysis of fading channels



3	Comparisons of digital modulation techniques in multipath environment
4	To study forward error correction coding technique
5	To study and analysis of various outdoor propagation models.
6	To study and analysis of different types of noise in wireless communication systems.
7	To study Direct –Sequence Spread spectrum communication system.
8	To study frequency hopped spread spectrum communication system
9	To study MIMO based communication Systems.
10	To study Channel estimation algorithms.
11	To study BLAST architecture

Supplementary learning Material:

1	http://www.sss-mag.com/
2	http://agilent.co.in (Application Notes)
3	http://itu.int

Curriculum Revision:

Version:	1
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22