NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	BTech Electronics & Communication Engineering
Course Code:	3EC305ME24
Course Title:	Wireless Communication
Course Type:	Departmental Elective
Year of Introduction:	2024-25

L	T	Practical component				C
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Course Learning Outcomes (CLOs)

At the end of the course, the students will be able to-

1. comprehend the mobile communication standards- GSM and IS95. (BL2)
2. utilise the concepts of statistics in wireless communications. (BL3)
3. model the wireless channel. (BL4)
4. evaluate the performance of wireless communication system with diversity schemes, MIMO and OFDM. (BL5)

	Contents	Teaching hours (Total 45)
Unit I	**Mobile Radio Propagation**: Characterization of wireless channels, large scale effects, small scale effects, channel models, capacity of wireless channel	**05**
Unit II	**Cellular Communication Concepts**: Frequency reuse, co-channel and adjacent channel interference, handoff techniques, channel assignment techniques	**05**
Unit III	**Techniques to Improve Capacity and Reduce Interference**: Modulation techniques: constant envelope modulation-MSK, GMSK, combined and linear modulation techniques-MPSK, QAM	**05**
Unit IV	**Equalisation, Diversity**: Fundamentals of equalisation, generic adaptive equalisation, survey of equalisation techniques, linear equalisers, non-linear equalisation, algorithms for adaptive equalisation, diversity techniques, maximal ratio combining (MRC), equal gain combining (EGC), selection combining (SC), transmit beamforming (TB), space time block coding (STBC), Alamouti code, polarisation diversity, frequency diversity, time diversity, rake receiver, multi input multi output (MIMO) systems, TB-MRC and Alamouti-EGC systems, high data rate communication with Orthogonal frequency division multiplexing (OFDM), Performance analysis of wireless communication systems in Rayleigh fading channel	**15**
Unit V	**Case studies of Cellular Standards**: Different multiple access schemes, Time division multiple access (TDMA), frequency division multiple access (FDMA), code division multiple access (CDMA), overview and specifications of GSM standard, frame structure, channels, source coding, channel coding and security in GSM, CDMA based standard IS95 and its specifications, frame structure and channels in IS95, Walsh code and PN codes in IS95, channel coding and scrambling in IS95, 2.5 G – GPRS and 3G standards- WCDMA, packet error rate in 3G network	**15**

Self-Study:
The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Laboratory Work: Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Suggested Readings/Reference:

1. Theodore S. Rappaport, Wireless communications, principles and practices, Pearson Education
2. Goldsmith, Wireless Communication, Cambridge university press
3. D. Tse & P. Viswanath, Fundamental of wireless communication, Cambridge university press
4. T. L. Singal, Wireless Communication, Tata McGraw-Hill
5. Kemilo Feher, Wireless Digital Communication, Prentice Hall
6. Upena Dalal, Wireless Communication, Oxford university press

Details of Laboratory
Suggested List of Experiments

Sr. No.	Practical	No. of Hours
1.	Simulation and analysis of Coherent Binary detection in Rayleigh fading channel using simulations	02
2.	Analyse BER versus SNR performance of binary Differential Phase Shift Keying in Rayleigh fading channel using simulations	02
3.	Performance analysis of Coherent and non-coherent detection of Frequency Shift Keying (FSK) in Rayleigh fading channel using simulations	02
4.	Analyse of receive diversity using MRC and EGC in Rayleigh fading channel using simulations	02
5.	Simulation of space time coding in Rayleigh fading channel.	02
6.	Analyse BER versus SNR performance of transmit beamforming (TB) in Rayleigh fading channel using simulations	02
7.	Analysis of TB-MRC in MIMO systems in Rayleigh fading channel using simulations	02
8.	Space time coding with EGC in MIMO systems in Rayleigh fading channel using simulations	02
9.	Analyse BER versus SNR performance of spatial multiplexing in MIMO system in Rayleigh fading channel.	02
10.	Analyse the effect of spatial correlation in MIMO systems in Rayleigh fading channel	02
11.	Analyse the imperfection of channel state information at detector in MIMO systems in Rayleigh fading channel	02
12.	Analyse BER versus SNR performance of MIMO system with antenna selection in Rayleigh fading channel using simulations	02
13.	Analyse performance of OFDM system in Rayleigh fading channel using simulations	02
14.	Analyse the effect of Rayleigh fading channel on image transmission.	02
15.	Analyse the channel capacity of MIMO systems in Rayleigh fading channels	02