

NIRMA UNIVERSITY

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| Institute: | Institute of Technology, School of Technology |
| Name of Programme: | B.Tech. in Electronics & Communication Engineering |
| Course Code: | 4EC303ME25 |
| Course Title: | Broadband Wireless Communication |
| Course Type: | Department Elective |
| Year of Introduction: | 2025-26 |

| 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 apply multi-carrier modulation in broadband wireless communication (BL3)
- 2 analyse MIMO system and scheduling algorithms in LTE (BL4)
- 3 use 5G networks for low power communication using IoT (BL5)
- 4 evaluate the performance of broadband communication using LTE advanced. (BL5)

| Unit | Contents | Teaching hours (Total 45) |
|-----------------|---|------------------------------|
| Unit I | Multicarrier Modulation: High data rate communication, frequency selective channels, Orthogonal Frequency Division Multiplexing (OFDM), Single Carrier FDMA (SC-FDMA), OFDM based multiple access (OFDMA), cyclic prefix. | 05 |
| Unit II | MIMO Systems and Scheduling: Diversity techniques and spatial multiplexing in MIMO systems, scheduling, link adaptation, and Hybrid ARQ, different transmission modes in Long Term Evolution (LTE) systems. | 05 |
| Unit III | Long-Term-Evolution (LTE) Cellular Networks: Network architecture, physical layer, resource management, downlink physical layer processing, uplink physical layer processing, access procedures | 12 |
| Unit IV | LTE Advanced: Different features of Release 10 and onward, Carrier Aggregation, enhanced MIMO systems, CoMP technology, Heterogeneous networks, device-to-device communication, machine-to-machine communications, Data offloading, 3D MIMO. | 09 |
| Unit V | 5G Networks: Drivers for 5G, 5G Internet, Internet of Things (IoT), small cells for 5G mobile networks, mobile clouds, security in 5G networks. | 09 |
| Unit VI | Spectrum Sensing Techniques: Spectrum Sensing Techniques in Cognitive Radio: Energy detection, Cooperative sensing, Receiver operating characteristics (RoC) | 05 |

Self Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the question will be asked from self-study contents.

Tutorial Work: This shall consist of at least 10 tutorials based on the above syllabus.

Suggested Readings/ Reference:

1. E Dahlman, S. Parkvall, J Skold, *4G LTE/LTE Advanced for Mobile broadband*, Academic Press, Elsevier
2. X. Zhang, X. Zhou, *LTE Advanced Air Interface Technology*, CRC Press
3. J. Rodriguez, *Fundamentals of 5G Mobile Networks*, John Wiley

Suggested List of Tutorials

| Sr. No. | Name of Experiments/Exercises | Hours |
|------------|--|-------|
| 1. | Single input multiple output system (SIMO) | 01 |
| 2. | Multi input multi output system (MIMO) | 01 |
| 3. | Orthogonal Division multiplexing (OFDM) | 01 |
| 4. | Space frequency block code | 01 |
| 5. | Spatial multiplexing | 01 |
| 6. | Scheduling | 01 |
| 7. | Heterogeneous networks | 01 |
| 8. | Carrier aggregation | 01 |
| 9. | Coordinated Multi point (CoMP) technology | 01 |
| 10. | Turbo codes | 01 |
| 11. | Device to device communication | 01 |
| 12. | Relaying | 01 |
| 13. | Data offloading | 01 |
| 14. | Resource management in LTE | 01 |
| 15. | Spectrum sensing in cognitive radio | 01 |