**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (ECE)– IV-II**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## (19A04801a) ADVANCED 3G AND 4G WIRELESS MOBILE COMMUNICATIONS

Professional Elective - IV

**Course Objectives:**

- To understand the concepts of wireless communications and standards (L1).
- To apply a wireless technique to solve engineering problem (L2).
- To analyze working of wireless technologies (L3).
- To evaluate a wireless technique in a given situation (L4).
- To plan a wireless system for deployment (L5).

**UNIT-I:**

Introduction to 3G and 4G standards.

**Teletraffic Theory:**

Introduction to teletraffic theory, Cellular traffic modelling and blocking probability.

**Large Scale Path Loss:**

Introduction to wireless propagation models, Ground reflection model, Okumura model, Hata model, Link budget analysis,Log normal shadowing.

**Learning Outcomes:**

At the end of the unit, student shall be able to

- Understand the concept of a standard, teletraffic and signal loss model (L1).
- Apply a model to study the signal losses (L2).
- Analyzethe suitability of a model to a given situation (L3).
- Evaluate a model in a given situation (L4).
- Plan a wireless system for deployment (L5).

**UNIT-II:**

**Small Scale Fading and Multipath:**

Fading in wireless channel, Rayleigh fading, BER in wired and wireless channels. Wireless channel and delay spread, Coherence bandwidth of wireless channel, ISI and Doppler in wireless channel, Doppler spectrum and Jake’s model.

**Diversity Techniques:**

Introduction to diversity techniques, MRC for multi-antenna system, BER with diversity, Spatial diversity and diversity order.

**Learning Outcomes:**

At the end of the unit, student shall be able to

- Understand the concept of fading and diversity (L1).
- Apply a diversity technique to improve BER (L2)
- Compare various diversity techniques (L3)
- Evaluate channel model in a given situation (L4)

**UNIT-III:**

**Code Division Multiple Access**

Introduction to CDMA, spread spectrum and LFSR. Generation and properties of PN sequences, Correlation of PN sequences and Jammer margin, CDMA advantages and RAKE receiver, Multiuser CDMA downlink,Multiuser CDMA uplink and asynchronous CDMA, CDMA near-far problem.

**Learning Outcomes:**

At the end of the unit, student shall be able to

- Understand the concept of PN sequence (L1).
- Apply CDMA in a multiuser environment (L2).
- Analyze near-far problem (L3).
- Evaluate CDMA technique in a multiuser environment (L4).

**UNIT-IV:**

**Multiple Input Multiple Output Systems:**

Introduction to MIMO, MIMO system model, Zero-forcing receiver, MIMO MMSE receiver, Introduction to SVD, SVD based optimal MIMO transmission and capacity, OSTBCs, V-blast receiver, MIMO beam forming.

**Orthogonal Frequency Division Multiplexing:**

Introduction to OFDM, Multicarrier modulation, IFFT sampling for OFDM, OFDM schematic, Cyclic prefix, OFDM based parallelization, OFDM examples.

**Learning Outcomes:**

At the end of the unit, student shall be able to

- Understand the concept of MIMO and OFDM (L1).
- Apply MIMO/ OFDM techniques in a given situation (L2).
- Analyze working of MIMO/ OFDM systems (L3).
- Evaluate aMIMO/ OFDM techniques in a given situation (L4).

**UNIT-V:**

**MIMO-OFDM:**
Introduction to MIMO-OFDM, Impact of carrier frequency offset in OFDM, PAPR in OFDM systems, Introduction to SC-FDMA.
**3G and 4G Standards:**
WCDMA, LTE/ LTE Advanced and WiMAX.

**Learning Outcomes:**

At the end of the unit, student shall be able to
- Understand 3G and 4G standards and the combined concept of MIMO-OFDM (L1).
- Apply MIMO-OFDM techniques in a given situation (L2).
- Analyze working of MIMO-OFDM systems (L3).
- Evaluate aMIMO-OFDM techniques in a given situation (L4).

**Course Outcomes:**

At the end of the course, the student should be able to
- Understand the concepts of wireless communications and standards (L1).
- Apply a wireless technique to solve engineering problem (L2).
- Analyze working of wireless technologies (L3).
- Evaluate a wireless technique in a given situation (L4).
- Plan a wireless system for deployment (L5).

**REFERENCES:**

3. Aditya K. Jagannatham, "Principles of Modern Wireless Communications Systems – Theory and Practice", McGraw-Hill International, 2015.
4. Theodore S. Rappaport, "Wireless Communications – Principles and Practice", 2nd Edition, PHI, 2004.
5. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communications", Cambridge University Press.
6. Andrea Goldsmith, "Wireless Communications", Cambridge University Press.
7. Ezio Biglieri, "MIMO Wireless Communications", Cambridge University Press.