Subject title: Mobile Radio Communications

Subject code: EIE531

Credit value:

3

Responsible staff and department:

Dr Kainam Thomas Wong, EIE

Pre-requisite:

AMA305 Probability & Engineering Statistics
EIE312 Linear Systems
EIE331 Communication Fundamentals
EIE413 Digital Signal Processing (recommended)

Recommended background knowledge:

Undergraduate knowledge of probability and stochastic processes, analog and digital communications is required.

Mutual exclusions: EIE447 Mobile Communications

Learning approach:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture/Tutorial</td>
<td>33 hours</td>
</tr>
<tr>
<td>Mini-project</td>
<td>9 hours</td>
</tr>
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Assessment:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Continuous Assessment</td>
<td>40%</td>
</tr>
<tr>
<td>Examination</td>
<td>60%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
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</tbody>
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Objectives:

1. To introduce the fundamental issues, concepts, and design principles in cellular and/or mobile communications.
2. To mathematically model how various channel-fading phenomena degrades a transmitted wireless signal.
3. To introduce equalization methods to combat channel-fading.
4. To introduce basic cellular-mobile transmission formats: FDMA, TDMA, DS-CDMA, FH-CDMA, OFDM, SC-CP.
Keyword syllabus:

1. **Introduction to Cellular-Mobile Radiowave Wireless-Communication Systems**
   Cellular structure, frequency reuse & cells splitting. Channel assignment. Co-channel interference, adjacent-channel interference, system capacity, and power control.

2. **Radiowave Propagation’s Macroscopic-Fading Models**

3. **Radiowave Propagation’s Microscopic-Fading Models**
   Lognormal, Rician, and Rayleigh fading models. Doppler frequency, delay spread, coherence bandwidth, level crossing rate. Characterisation of multipath phenomena. Fading effects due to multi-path time delay spread. Fading effects due to Doppler spread. Simulation of fading channels.

4. **Equalization**
   Linear equalizers, nonlinear equalizers, adaptive equalizers, RAKE receivers.

5. **Current Cellular-Mobile Communication Multiple-Access Schemes & Standards**
   Multiple-access schemes: frequency-division multiple-access (FDMA), time-Division multiple-access (TDMA), direct-sequence code-division multiple-access (DS-CDMA), frequency-hop code-division multiple-access (FH-CDMA), hybrid schemes, space-division multiple-access (SDMA), orthogonal frequency-division multiplexing (OFDM), orthogonal frequency-division multiple access (OFDMA), single-carrier cyclically-prefixed block-based modulation (SC-CP).

**Indicative reading list and references:**


**Suggested project:**

1. MATLAB simulation of channel fading
2. MATLAB simulations of a DS-CDMA transmitter and receiver.
3. MATLAB simulations of an OFDM transmitter and receiver.

June 2009