

**City University of Hong Kong  
Course Syllabus**

**offered by Department of Electrical Engineering  
with effect from Semester A in 2024/2025**

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**Part I Course Overview**

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| <b>Course Title:</b>                                  | Mobile Communication and Networks                  |
| <b>Course Code:</b>                                   | EE6453   |
| <b>Course Duration:</b>                               | One Semester (13 weeks)                            |
| <b>Credit Units:</b>                                  | 3  |
| <b>Level:</b>   | P6   |
| <b>Medium of Instruction:</b>                         | English  |
| <b>Medium of Assessment:</b>                          | English  |
| <b>Prerequisites:</b><br>(Course Code and Title)      | Nil  |
| <b>Precursors:</b><br>(Course Code and Title)         | EE3008 Principles of Communications; or equivalent |
| <b>Equivalent Courses:</b><br>(Course Code and Title) |  |
| <b>Exclusive Courses:</b><br>(Course Code and Title)  | Nil  |

## Part II Course Details

### 1. Abstract

The course aims to provide students with theoretical and technical knowledge in cellular mobile communications.

### 2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

| No. | CILOs  | Weighting<br>(if applicable) | Discovery-enriched curriculum related learning outcomes (please tick where appropriate) |    |    |
|-----|--|------------------------------|---|----|----|
|     |  |                              | A1  | A2 | A3 |
| 1.  | Evaluate and characterize the large-scale and small-scale propagation behaviour of wireless channels using empirical and statistical models, and apply effective techniques to combat multi-path fading. |                              |   | ✓  |    |
| 2.  | Analyze frequency reuse principles for the 1 <sup>st</sup> generation cellular systems.  |                              |   | ✓  |    |
| 3.  | Analyze coding and modulation techniques for the 2 <sup>nd</sup> generation cellular systems.  |                              |   | ✓  |    |
| 4.  | Analyze CDMA technology for the 3 <sup>rd</sup> generation cellular systems.   |                              |   | ✓  |    |
| 5.  | Analyze OFDM technology for the 4 <sup>th</sup> generation cellular systems.   |                              |   | ✓  |    |
| 6.  | Comment on new technology for future cellular systems.   |                              | ✓   |    |    |
|     |  | 100%                         |   |    |    |

A1: *Attitude*

*Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.*

A2: *Ability*

*Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.*

A3: *Accomplishments*

*Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.*

### 3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

| LTA     | Brief Description  | CILO No. |   |   |   |   |   | Hours/week (if applicable)   |
|---------|--|----------|---|---|---|---|---|--|
|         |  | 1        | 2 | 3 | 4 | 5 | 6 |  |
| Lecture | Students will be involved in lectures to gain knowledge about key concepts of mobile communication systems and networks. | ✓        | ✓ | ✓ | ✓ | ✓ | ✓ | 3 hrs/wk<br>(Some of the lecture hours will be used for tutorials) |

### 4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

| Assessment Tasks/Activities                        | CILO No. |   |   |   |   |   | Weighting | Remarks |
|--|----------|---|---|---|---|---|-----------|---------|
|  | 1        | 2 | 3 | 4 | 5 | 6 |           |         |
| Continuous Assessment: 50 %                        |          |   |   |   |   |   |           |         |
| Tests (min.: 2)                                    | ✓        | ✓ | ✓ | ✓ | ✓ | ✓ | 40%       |         |
| #Assignments (min.: 3)                             | ✓        | ✓ | ✓ | ✓ | ✓ | ✓ | 10%       |         |
| Examination: 50 % (duration: 2hrs , if applicable) |          |   |   |   |   |   |           |         |
| Examination  | ✓        | ✓ | ✓ | ✓ | ✓ | ✓ | 50 %      |         |
|  |          |   |   |   |   |   | 100%      |         |

#### Remark:

To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.  
# may include homework, tutorial exercise, project/mini-project, presentation

### 5. Assessment Rubrics

*(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)*

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

| Assessment Task | Criterion                | Excellent<br>(A+, A, A-) | Good<br>(B+, B, B-) | Fair<br>(C+, C, C-) | Marginal<br>(D) | Failure<br>(F)                      |
|-----------------|--------------------------|--------------------------|---------------------|---------------------|-----------------|-------------------------------------|
| 1. Examination  | Achievements in<br>CILOs | High                     | Significant         | Moderate            | Basic           | Not even reaching<br>marginal level |
| 2. Coursework   | Achievements in<br>CILOs | High                     | Significant         | Moderate            | Basic           | Not even reaching<br>marginal level |

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

| Assessment Task | Criterion             | Excellent<br>(A+, A, A-) | Good<br>(B+, B,) | Marginal<br>(B-, C+, C) | Failure<br>(F)                      |
|-----------------|-----------------------|--------------------------|------------------|-------------------------|-------------------------------------|
| 1. Examination  | Achievements in CILOs | High                     | Medium           | Low                     | Not even reaching marginal<br>level |
| 2. Coursework   | Achievements in CILOs | High                     | Medium           | Low                     | Not even reaching marginal<br>level |

## 6. Constructive Alignment with Programme Outcomes

| PILO           | How the course contribute to the specific PILO(s)  |
|----------------|--|
| 1, 2, 3, 4,5,6 | This course provides students with knowledge and various techniques for mobile communications. Students are encouraged to develop the ability to integrate their learning of the course into a real-world design in mobile communication systems and networks. |

### Part III Other Information (more details can be provided separately in the teaching plan)

#### 1. Keyword Syllabus

Signal propagation and mobile channels: Fast fading and slow fading; flat fading and frequency-selective fading; vehicle motion and Doppler frequency shift; coherence bandwidth and coherence time.

Cellular systems: Frequency reuse; reuse pattern; system capacity; channel assignment; signal to co-channel interference ratio; power control and handoff..

Modulation and coding techniques: Brief description of GSM; convolutional codes and turbo codes; generation polynomials; shift registers encoder; trellis diagram and Viterbi decoder; free distance and correction capability; Soft-in soft-output decoder.

CDMA systems: Brief description of IS-95; spreading codes; PN sequences; processing gains; interleaving.

OFDM systems: Brief description of LTE; DFT and FFT; adaptive loading; cyclic pre-fix; peak-to-average-power ratio; time-frequency resource.

Multiple antenna techniques: Beam patterns to nullify co-channel interferers; maximal ratio combining; equal gain combining; selection combining; diversity gain; space-division multiple access (SDMA).

#### 2. Reading List

##### 2.1 Compulsory Readings

*(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)*

|    |   |
|----|---|
| 1. | David Tse and Pramod Viswanath, <i>Fundamentals of Wireless Communication</i> , Cambridge University Press, 2005. |
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##### 2.2 Additional Readings

*(Additional references for students to learn to expand their knowledge about the subject.)*

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|----|---|
| 1. | Andrea Goldsmith, <i>Wireless Communications</i> , Cambridge University Press, 2005.                        |
| 2  | Andreas F. Molisch, <i>Wireless Communications</i> , John Wiley & Sons Ltd, 2005.                           |
| 3  | Dimitri Bertsekas and Robert Gallager, <i>Data Networks (2nd Edition)</i> , Prentice Hall, 1992.            |
| 4  | Robert G. Gallager, <i>Principles of Digital Communication</i> , Cambridge University Press, 2008.          |
| 5  | John G. Proakis and Masoud Salehi, <i>Digital Communications (5th Edition)</i> , McGraw Hill, 2005.         |
| 6  | B. Sklar, <i>Digital Communications: Fundamentals and Applications (2nd Edition)</i> , Prentice-Hall, 2001. |