

<b>COURSE</b>	Name	: Multicarrier Communication Systems
	Code	: EE185535
	Credit(s)	: 2
	Semester	: (Elective Course)

### Description of Course

The course of Multicarrier Communication Systems is an elective course that discusses the technique of high-speed message signal transmission (multiple data) using multiple signals (carrier) simultaneously (multiplexing) with the aim that the digital communication system is more resistant to multiple channel interferences in the form of frequency selective fading attenuation. The discussions include multicarrier transmission techniques especially orthogonal frequency division multiplexing (OFDM) techniques and generalized frequency division multiplexing (GFDM) techniques. The discussions also covers multiple code division multiple access (CDMA) access techniques using multicarrier multiplexing techniques namely MC-CDMA technique and discusses the combination of multiple-input-multiple-output (MIMO) diversity techniques and multicarrier multiplexing techniques called MIMO-OFDM techniques.

### Learning Outcomes

#### Knowledge

(P01) Mastering the concepts and principles of science in a comprehensive manner, and to develop procedures and strategies needed for the analysis and design of systems related to the field of power systems, control systems, multimedia telecommunications, electronics, intelligent multimedia network, or telematics as a preparation for further education or professional career.

#### Specific Skill

(KK01) Being able to formulate engineering problems with new ideas for the development of technology in power systems, control systems, multimedia telecommunications, electronics, intelligent multimedia network, or telematics.

(KK02) Being able to compose problem solving in engineering through depth and breadth of knowledge which adapts to changes in science and technology in power systems, control systems, multimedia telecommunications, electronics, intelligent multimedia network, or telematics.

#### General Skill

(KU11) Being able to implement information and communication technology in the context of execution of his/her work.

#### Attitude

(S09) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

(S12) Working together to be able to make the most of his/her potential.

### Course Learning Outcomes

#### Knowledge

Mastering the concepts of high speed signal transmission simultaneously (multiplexing) using multiple carrier signals (multicarrier) so that bandwidth requirements become more efficient and more resistant to more complex channel interferences, especially the interference with frequency selective fading channels.

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**Specific Skill**

Able to identify high speed data transmission problems and able to solve problems by applying transmission techniques using multicarrier signals and combining them with other techniques, namely CDMA multi access techniques and MIMO diversity techniques so that communication system performance becomes better.

**General Skill**

Able to perform communication signal processing for high speed data transmission by applying multicarrier-based multiplexing software (MATLAB).

**Attitude**

Demonstrating attitude of responsibility for work in the field of high-speed data transmission independently.

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**Main Subjects**

1. The concept of multiple channel digital communication in AWGN.
2. The concept of multicarrier modulation / orthogonal frequency division multiplexing (OFDM).
3. Characteristics of OFDM.
4. The concept of generalized frequency division multiplexing (GFDM).
5. MC-CDMA concept.
6. MIMO-OFDM concept.
7. Multicarrier communication system simulation using MATLAB software.

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**Reference(s)**

- [1] Lie-Liang Yang, Multicarrier communications. John Wiley & Sons, 2009.
- [2] Simon Litsyn, Peak power control in multicarrier communications. Cambridge University Press, 2007.
- [3] Man-On Pun, Michele Morelli, and CC Jay Kuo. Multi-carrier techniques for broadband wireless communications: a signal processing perspective. 2007.
- [4] Carl R. Nassar, Bala Natarajan, Zhiqiang Wu, David A. Wiegandt, S. Alireza Zekavat, and Steve Shattil. Multi-carrier technologies for wireless communication. Springer Science & Business Media, 2006.
- [5] Emad Hassan, Multi-Carrier Communication Systems with Examples in MATLAB®: A New Perspective, CRC Press, 2016.

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**Prerequisite(s)**

- Random Process and Statistical Signal Processing
  - Digital Communication Systems
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