



INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)
FAKULTAS TEKNOLOGI ELEKTRO DAN INFORMATIKA CERDAS
DEPARTEMEN TEKNIK ELEKTRO
Program Studi Sarjana (S1) Teknik Telekomunikasi

1	Nama Mata Kuliah : Teknologi Komunikasi Generasi Baru
2	Kode Mata Kuliah : EL234712
3	Kredit : 3 SKS
4	Semester : Pilihan

Deskripsi Mata Kuliah

Matakuliah Teknologi Komunikasi Generasi Baru membahas teknologi-teknologi baru pada sistem komunikasi nirkabel digital, khususnya yang diterapkan pada jaringan akses radio. Teknologi jaringan akses radio yang dimaksud meliputi pemanfaatan frekuensi pembawa yang lebih tinggi, penggunaan sistem multi-antena, penggunaan sistem modulasi multi-carrier, dan pemanfaatan teknik akses jamak.

Capaian Pembelajaran Lulusan (CPL) Yang Dibebankan Mata Kuliah

1. (CPL-03) Mampu mengelola pembelajaran diri sendiri, dan mengembangkan diri sebagai pribadi pembelajar sepanjang hayat untuk bersaing di tingkat nasional, maupun internasional, dalam rangka berkontribusi nyata untuk menyelesaikan masalah dengan mengimplementasikan teknologi informasi dan komunikasi dan memperhatikan prinsip keberlanjutan serta memahami kewirausahaan berbasis teknologi.
2. (CPL-04) Mampu menerapkan ilmu pengetahuan alam dan matematika serta teknologi dan rekayasa informasi untuk memperoleh pemahaman komprehensif pada bidang Teknik Telekomunikasi.
3. (CPL-08) Mampu mengetahui dan mengaplikasi metode dan keahlian sesuai perkembangan terkini di bidang ilmu pengetahuan dan teknologi untuk menyelesaikan permasalahan di bidang Teknik Telekomunikasi dengan mengedepankan nilai-nilai universal
4. (CPL-10) Mampu bekerja secara efektif dalam kelompok yang beranggotakan lintas disiplin dan budaya dengan menunjukkan sifat kepemimpinan, serta mampu merencanakan, melaksanakan dan mengevaluasi tugas pada kondisi yang diberikan.

Capaian Pembelajaran Mata Kuliah

1. Mampu menjelaskan prinsip pemodelan kanal radio berdasarkan mekanisme propagasi radio pada berbagai frekuensi
2. Mampu menjelaskan prinsip kerja sistem komunikasi multi-antena untuk meningkatkan kualitas sinyal dan kapasitas kanal
3. Mampu menjelaskan prinsip kerja sistem komunikasi multi-carrier untuk meningkatkan efisiensi spektrum
4. Mampu menjelaskan prinsip kerja berbagai teknik akses jamak

5. Mampu menjelaskan prinsip kerja jaringan akses radio pada sistem komunikasi generasi baru
6. Mampu mengevaluasi kinerja jaringan akses radio pada sistem komunikasi generasi baru dan mengusulkan gagasan use case

Pokok Bahasan

1. Tinjauan sistem komunikasi generasi baru (4G, 5G, 6G)
2. Pemodelan kanal radio sebagai sistem LTI
3. Dampak kanal fading terhadap sistem komunikasi nirkabel digital
4. Antena phased array
5. Sistem komunikasi dengan beamforming MVDR
6. Sistem komunikasi MIMO
7. Sistem massive MIMO
8. BS diversity dan D-MIMO
9. Sistem komunikasi multi-carrier OFDM
10. Agregasi sub-carrier dan PAPR
11. Teknik akses jamak konvensional
12. Teknik akses jamak
13. Prinsip kerja, arsitektur, dan kinerja jaringan akses radio (Core Network, Cloud, C-RAN, CoMP)
14. Tinjauan perkembangan teknologi komunikasi masa depan

Prasyarat

Sistem Komunikasi, Jaringan Komunikasi Nirkabel, Antena dan Propagasi Radio

Pustaka

Utama :

1. Theodore Rappaport, Robert Heath Jr., Robert Daniels, James Murdock, Millimeter Wave Wireless Communications, Pearson, 2014.
2. Constantine A. Balanis, Antenna Theory: Analysis and Design, ed. 4, Wiley, 2016.
3. Simon Haykin, Adaptive Filter Theory, ed. 5, Pearson, 2014.
4. John Proakis, Masoud Salehi, Digital Communications, ed. 5, McGraw-Hill, 2007.
5. Erik Dahlman, Stefan Parkvall, Johan Skold, 5G NR: The Next Generation Wireless Access Technology, 2nd ed., Academic Press, 2020.

Pendukung:

1. John A. Richards, Radio Wave Propagation: An Introduction for the Non-Specialist, Springer, 2008
2. Sana Salous, Radio Propagation Measurement and Channel Modelling, Wiley, 2013.
3. Christopher Cox, An Introduction to 5G: The New Radio, 5G Network and Beyond, John Wiley and Sons, 2020.
4. Sasha Sirotkin, 5G Radio Access Network Architecture: The Dark Side of 5G, John Wiley and Sons, 2021
5. Guy Pujolle, Software Networks, 2nd ed., John Wiley and Sons, 2020.



INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)
FACULTY OF INTELLIGENT ELECTRICAL AND INFORMATICS TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING
Undergraduate Study Programme (S1) Telecommunication Engineering

1	Course Name	: New Generation Communication Technology
2	Course Code	: EL234712
3	Credit	: 3 CREDITS
4	Semester	: Options

Course Description

The New Generation Communication Technology course discusses new technologies in digital wireless communication systems, especially those applied to radio access networks. The radio access network technologies include the use of higher carrier frequencies, the use of multi-antenna systems, the use of multi-carrier modulation systems, and the use of multiple access techniques.

Graduate Learning Outcomes (SLOs) Charged Courses

1. (CPL-03) Able to manage one's own learning, and develop oneself as a lifelong learner to compete at the national and international levels, in order to contribute significantly to solving problems by implementing information and communication technology and paying attention to the principles of sustainability and understanding technology-based entrepreneurship.
2. (CPL-04) Able to apply natural science and mathematics as well as technology and information engineering to gain a comprehensive understanding of the field of Telecommunication Engineering.
3. (CPL-08) Able to know and apply methods and expertise according to the latest developments in the field of science and technology to solve problems in the field of Telecommunication Engineering by promoting universal values.
4. (ELO-10) Able to work effectively in interdisciplinary and cultural groups by showing leadership characteristics, and able to plan, implement and evaluate tasks under given conditions.

Course Learning Outcomes

1. Able to explain the principles of radio channel modelling based on radio propagation mechanisms at various frequencies
2. Able to explain the working principle of multi-antenna communication system to improve signal quality and channel capacity
3. Able to explain the working principle of multi-carrier communication system to improve spectrum efficiency
4. Able to explain the working principles of various multiple access techniques

5. Able to explain the working principle of radio access network in new generation communication system
6. Able to evaluate the performance of radio access networks in communication systems
new generation and propose use case ideas

Subject matter

1. Overview of new generation communication systems (4G, 5G, 6G)
2. Modelling the radio channel as an LTI system
3. Impact of channel fading on digital wireless communication systems
4. Phased array antenna
5. Communication system with MVDR beamforming
6. MIMO communication system
7. Massive MIMO system
8. BS diversity and D-MIMO
9. OFDM multi-carrier communication system
10. Sub-carrier aggregation and PAPR
11. Conventional multiple access techniques
12. Multiple access techniques
13. Working principles, architecture, and performance of radio access networks
(Core Network, Cloud, C- RAN, CoMP)
14. Overview of future communication technology developments

Prerequisites

Communication Systems, Wireless Communication Networks, Antennas and Radio Propagation

Library

Main:

1. Theodore Rappaport, Robert Heath Jr., Robert Daniels, James Murdock, Millimeter Wave Wireless Communications, Pearson, 2014.
2. Constantine A. Balanis, Antenna Theory: Analysis and Design, 4th ed. 4, Wiley, 2016.
3. Simon Haykin, Adaptive Filter Theory, ed. 5, Pearson, 2014.
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5. Erik Dahlman, Stefan Parkvall, Johan Skold, 5G NR: The Next Generation Wireless Access Technology, 2nd ed., Academic Press, 2020.

Supporters:

1. John A. Richards, Radio Wave Propagation: An Introduction for the Non-Specialist, Springer, 2008.
2. Sana Salous, Radio Propagation Measurement and Channel Modelling, Wiley, 2013.
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