EUROPEAN UNIVERSITY

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EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION

STUDY GUIDE

MODERN WIRELESS COMMUNICATIONS AND APPLICATIONS

Organised by

University of Vaasa

Brandenburg University of Technology Cottbus - Senftenberg · Universidad de Cantabria · Università di Catania · Université Polytechnique Hauts-de-France · UMONS University of Mons · University of the Peloponnese · Vaasan yliopisto University of Vaasa · Politécnico de Viseu

1. IDENTIFYING DATA.	
· Course Name.	*Modern Wireless Communications and Applications*
· Coordinating University.	*University of Vaasa*
· Partner University(ies) Involved.	-
· Course Field(s).	*Information, Communication, and Automation Technology*
· Related Study Programme.	*Energy and Information Technology; Smart Energy*
· Course Code.	*ICAT3220*
· ISCED Code.	*0618*
· SDG.	*Goal 4: Quality education* *Goal 9: Industry, Innovation and Infrastructure*
· Study Level.	*M*

· Number of ECTS credits allocated.	*5*
· Mode of Delivery.	*Online synchronous*
· Language of Instruction.	*English*
· Delivery Period.	*Winter semester 2024*
· Course Dates.	*21 Oct 2024 to 28 November 2024*
· Precise Schedule of the Lectures.	**Time zone: Europe/Helsinki** *21 Oct 2024 14.00 - 16.00* *23 Oct 2024 14.00 - 16.00* *28 Oct 2024 10.00 - 12.00* *30 Oct 2024 14.00 - 16.00* *04 Nov 2024 10.00 - 12.00* *07 Nov 2024 12.00 - 14.00* *11 Nov 2024 12.00 - 14.00* *13 Nov 2024 10.00 - 12.00* *18 Nov 2024 10.00 - 12.00* *20 Nov 2024 10.00 - 12.00* *25 Nov 2024 10.00 - 12.00* *28 Nov 2024 12.00 - 14.00*
· Key Words.	*Wireless communication, coding, MIMO, 5G, Cloud/Edge, digital communication, IoT*

· Catchy Phrase.	*At the end of the course, you will be introduced to the fundamental and concepts of telecommunications, telecommunication systems, and applications.*

· Prerequisites and co-requisites.	*- English B2* *- It is expected that the students are familiar with university-level mathematics like integration, differentiation, complex numbers, linear algebra, Fourier series, and transforms. However, this is not necessary to take the course.*
· Number of EUNICE students that can attend the Course.	*120*
· Course inscription procedure(s).	*Enrolment via the EUNICE website*

2. CONTACT DETAILS.	
· Department.	*School of Technology and Innovations*
· Name of Lecturer.	*Mohammed Elmusrati*
· E-mail.	*mohammed.elmusrati@uwasa.fi*
· Office.	-
· Other Lecturers.	-

3. COURSE CONTENT.

The course has been designed to be beneficial for a broad spectrum of participants. The course focuses on the fundamentals and concepts of telecommunications, telecommunication systems, and applications. Time-Frequency domain relations, modulation techniques, antennas, digital communication, correlator receivers, transmitters and receivers, coding and decoding techniques, PAN (Bluetooth, Zigbee, NFC, RFID), WiFi (802.11X), LoRaWAN networks and Cellular networks (GSM, 3G, 4G, and 5G) are among the topics of this course

4. LEARNING OUTCOMES.

Students who complete this course successfully will at least:

Be aware of the main concepts of telecommunication.
Understand the main challenges of wireless communication and how they have been addressed.
Be aware of telecommunication quality measures.

Be aware of the concepts of digital communication and multiple access.
Be aware of new telecommunication technologies such as MIMO, Carrier aggregation, NOMA, etc.
Understand some telecommunication standards and technologies (e.g., WiFi, PAN, LoRaWAN, cellular networks including LTE-Advances and 5G networks) and be able to select the appropriate technology for specific applications.
Get to know the operation of wireless sensor networks.
Be aware of cloud computing.
Be aware of UAV, CubeSAT, Cognitive Radios, and Edge Computing.

5. OBJECTIVES.

Wireless communication has progressed exponentially in all dimensions recently. Besides its main application in connecting people either over voice or multimedia and social networks, it also offers essential platforms for human-to-machine and machine-to-machine communications. Therefore, it could be embedded in the most intelligent autonomous systems.

The objective of this course is to provide rich, diverse, and up-to-date material about telecommunication technology.

6. COURSE ORGANISATION.

UNITS	
1.	*Time-Frequency domain relations*
2.	*Foundations of digital communication, correlator receivers*
3.	*Wireless channels, noise, fading, ISI*
4.	*Advanced modulation techniques: CDMA, OFDM*
5.	*Receivers, Software-defined Radio (SDR)*
6.	*MIMO, opportunistic scheduling, communication quality (SNR, Packet losses, Data rates, Throughputs, Outages, Delay and Latency, QoS, QoE)*
7.	*PAN (Bluetooth, Zigbee, NFC, RFID), WiFi (802.11X), LoRaWAN networks*
8.	*Cellular networks (GSM, 3G, 4G, and 5G)*
9.	*wireless sensor networks, CubeSAT, UAV networks, Cognitive Radios, Edge and cloud computing, IoT and applications*

LEARNING RESOURCES AND TOOLS.

Lecturer notes, books, articles, and videos.

PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.

Lectures 24 h, independent work 111 h.

7. ASSESSMENT METHODS AND CRITERIA.
12 online quizzes. *Grading: On a scale of 1-5, or fail (0)*
OBSERVATIONS.
Recognition-related issues: *Please contact your home university's International Relations Office if you encounter any issues related to the recognition of the ECTS at the end of the course. Lecturers are not in charge of the recognition process.*

8. BIBLIOGRAPHY AND TEACHING MATERIALS.
Lecturer Notes *Additional material (will be updated later)*