

SYLLABUS

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| General information | Title and code of subject, number of credits | ETR 401 Wireless communication technology 6 ECTS | |
| | Department | Physics and Electronics | |
| | Program | Bachelor | |
| | Academic semester | 2022 fall | |
| | Lecturer | MSc, MIET, Alim Huseynov | |
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| | Phone number: | +99455 425 3599 | |
| | Lecture room/Schedule | 11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room | |
| Course language | English | | |
| Type of the subject | Major | | |
| Textbooks and additional materials | Textbooks: <ol style="list-style-type: none"> 1. Wireless Communication Networks and Systems; Cory Beard, William Stallings 2. Wireless Communications Systems; Randy L. Haupt 3. Wireless Communications; Andrea Goldsmith | | |
| Teaching methods | Lecture | | + |
| | Group discussions | | + |
| Assessment | Components | Date/ Deadline | Percent (%) |
| | Activity | At each lesson | 10 |
| | Quizzes | During the semester | 10 |
| | Attendance | At each lesson | 10 |
| | Midterm exam | | 30 |
| | Final exam | | 40 |
| | Final | | 100 |
| Course description | <p>The course addresses the fundamentals of wireless communications and provides an overview of existing and emerging wireless communications networks. It covers radio propagation and fading models, fundamentals of cellular communications, multiple access technologies, and various wireless networks, including past and future generation networks. Simulation of wireless systems under different channel environments will be integral part of this course.</p> | | |
| Course objectives | <p>Wireless communication is one of the fastest growing fields in the engineering world, and a tremendous interest for this topic exists among undergraduate students. To understand the examples of wireless communication systems, paging systems, cordless telephone systems. To study the different generations of mobile networks, WAN and PAN. To understand the concepts of basic cellular system, frequency reuse, channel assignment strategies, handoff strategies, interference. To understand the FDMA, TDMA, spread spectrum multiple access. To study the Wireless Networking: Difference between wireless and fixed telephone networks, development of wireless networks. When completing this course, the students should be able to understand the basic concept of wireless system design and get familiar with various wireless networks.</p> | | |
| Learning outcomes | <p>What students should know by the end of the course:</p> <ol style="list-style-type: none"> 1. Overview of wireless communications and systems Review of digital communications Cellular systems from 1G to 3G Wireless 4G, 5G systems 2. Radio propagation and propagation path-loss model Free-space attenuation Multipath channel characteristics Signal fading statistics Path-loss models 3. Fundamentals of cellular communications Hexagonal cell geometry Co-channel interference Cellular system design Sectoring using directional antennas 4. Multiple access techniques Frequency division multiple access (FDMA) Time division multiple access (TDMA) Code division multiple access (CDMA) Space division multiple access (SDMA) Orthogonal frequency division multiplexing (OFDM) Multicarrier CDMA (MC-CDMA) Random access methods 5. Wide-area wireless networks (WANs) GSM – IS-136 IS-95 UMTS Cdma2000 6. Long Term Evolution Technologies (LTE) OFDM MIMO channels Space Time Codes LTE Advanced 7. Other Wireless systems IEEE 802.11 WLAN (WiFi) WiMAX | | |

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| Rules (Educational policy and behavior) | <p><u>Lesson organization</u> General information on the subject will be provided for the students during lectures. Student's knowledge on the previous topics will be evaluated and new topic will be explained by mins of visual aids during seminars. Student's knowledge level will be tested orally and in written forms before midterm and final exams. Submission of the individual works by the end of course is obligatory.</p> <p><u>Attendance</u> Participation of students at all classes is important. Students should inform dean's office about missing lessons for particular reasons (illness, family issues and etc.). Students, missing more than 25% of lessons, are not allowed to take the exam.</p> <p><u>Tests</u> Those students who have informed the teacher and the dean's office about missing the test in advance for particular reasons, are allowed to take the test next week.</p> <p><u>Exams</u> All the issues related to the participation and admission to the exam are regulated by the faculty dean. Topics of midterm and final exams are provided for the students before the exams. The questions of midterm exam are not repeated in the final exam.</p> <p><u>Violation of the rules of the exams</u> Disrupting the test and taking copy during midterm and final exams is forbidden. Test papers of the student who do not follow these rules are canceled and the students are expelled from the test by getting 0 (zero).</p> <p><u>The rule for completing the course</u> In accordance with the University rules the overall success rate to complete the course should be 60% or above. The students who failed the exam would be to take this subject next semester or next year.</p> <p><u>Rules of conduct for Students</u> Disruption of the lesson and not following ethical norms during the lesson, as well as conduction of the discussions by the students without permission and using mobile phones is forbidden.</p> <p>Quizzes There will be a quiz during the semester. The quizzes will be announced in the classroom two weeks before and will relate to homework. Each quiz will be evaluated out of 5 points</p> <p>Activity Students who will be active during discussion of past lessons will be awarded with one activity mark.</p> <p>Attendance Students who attend the whole classes will get 10 marks. for three absence student loses 1 mark.</p> |
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This program reflects the comprehensive information about the subject and information about any changes will be provided in advance.

| Week | Subject topics | Textbooks / Assignments |
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| 1. | Introduction to Wireless Communications, The Global Cellular Network, The Mobile Device Revolution, Future Trends, The Trouble with Wireless | [1] p01 [2] p39 [3] p30 |
| | Conduction of oral and written survey. Problem solving | |
| 2. | Transmission Fundamentals, Signals for Conveying Information, Analog and Digital Data Transmission, Channel Capacity Transmission | [1] p09 [2] p47 |
| | Conduction of oral and written survey. Problem solving | |
| 3. | Communication Networks, LANs, MANs, and WANs, Switching Techniques, Circuit Switching, Packet Switching, Quality of Service | [1] p40 |
| | Conduction of oral and written survey. Problem solving | |
| 4. | Protocols and the TCP/IP Suite, The Need for a Protocol Architecture, The TCP/IP Protocol Architecture, The OSI Model, Internetworking | [1] p62 [2] p428 [3] p564 |
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| | Conduction of oral and written survey. Problem solving | |
| 5. | Overview of Wireless Communication, Spectrum Considerations, Line-Of-Sight Transmission, Fading in the Mobile Environment, Channel Correction Mechanisms, Digital Signal Encoding Techniques, Coding and Error Control, Orthogonal Frequency Division Multiplexing (OFDM), Spread Spectrum | [1] p93 [3]p374 |
| | Quiz 1 - Lecture 1 – Lecture 4 | |
| 6. | The Wireless Channel, Antennas, Spectrum Considerations, Line-Of-Sight Transmission, Fading in the Mobile Environment | [1] p156 [2] p139 |
| | Conduction of oral and written survey. Problem solving | |
| 7. | Signal Encoding Techniques, Signal Encoding Criteria, Digital Data, Analog Signals, Analog Data, Analog Signals, Analog Data, Digital Signals, | [1] 201 |
| | Quiz 2 - Lecture 5 – Lecture 6 | |
| 8. | Mid term exam | |
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| 9. | Orthogonal Frequency Division Multiplexing, Orthogonal Frequency Division Multiplexing. Orthogonal Frequency Division Multiple Access (OFDMA), Single-Carrier FDMA , Spread Spectrum, The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum. Direct Sequence Spread Spectrum, Code Division Multiple Access | [1] p252 [1] p432 [1] p236 [3] p403 |
| | Conduction of oral and written survey. Problem solving | |
| 10. | Coding and Error Control, Error Detection, Block Error, Correction Codes, Convolutional Codes, Automatic Repeat Request | [1] p273 |
| | Conduction of oral and written survey. Problem solving | |
| 11. | Wireless LAN Technology, IEEE 802 Architecture, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical Layer, Gigabit Wi-Fi, Other IEEE 802.11 Standards, IEEE 802.11I Wireless LAN Security 3 | [1] p321 [3] p 564 |
| | Quiz 3 - Lecture 7 – Lecture 10 | |
| 12. | Bluetooth and IEEE 802.15, The Internet of Things, Bluetooth Motivation and Overview, Bluetooth Specifications, Bluetooth High Speed and Bluetooth Smart, IEEE 802.15, ZigBee | [1] p376 |
| | Conduction of oral and written survey. Problem solving | |
| 13. | Cellular Wireless Networks, Principles of Cellular Networks, First-Generation Analog, Second-Generation TDMA, Second-Generation, CDMA, Third-Generation Systems | [1] p 409 |
| | Conduction of oral and written survey. Problem solving | |
| 14. | Fourth Generation Systems and LTE-Advanced, Purpose, Motivation, and Approach to 4G, LTE Architecture, Evolved Packet Core, LTE Resource Management, LTE Channel Structure and Protocols, LTE Radio Access Network | [1] p451 |
| | Quiz 4 - Lecture 11 – Lecture 13 | |
| 15. | Long Range Communications, Satellite Parameters and Configurations Satellite Capacity Allocation Satellite Applications, Fixed Broadband Wireless Access, WiMAX/IEEE, Smart Grid | [1] p525 |
| | Solving problems and ambiguities of students about the course | |

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| Solving extra examples | |
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