Wireless and Sensor Networks
Course Syllabus

This course contributes to the requirements for the Degree of MSc in Computer Science

Title of the Academic Program	Master's Degree Programs in English "Digital intelligent control systems"
Type of the course	elective
Course period	1 semester from October, the 1st to February, the 1st (18 weeks)
Study credits	3 ECTS credits
Duration	108 hours
Language of instruction	English
Academic requirements	– BSc degree in Computer Science or equivalent (transcript of records), – good command of English (certificate or other official document) **Prerequisites:** – **base knowledge of** electronics, physics, basic PC user skills.

Course Description

«Wireless and Sensor Networks» is an elective course.

The course will introduce students to data transfer over wireless media. Digital signal modulation and coding schemes, electromagnetic waves propagation and data decoding are considered. IEEE 802.11 (Wi-Fi) is a wireless data link-layer protocol engineered specially for wireless media.

Students will learn wireless network design, operation and testing; wireless network equipment configuration, wireless network security.

The course will use Cisco ISR 1803 wireless routers (with wired network infrastructure and control-plane network).

Special Features of the Course

The course provides an opportunity for students to work personally using electronic and test equipment. The student will be able to build wireless network using modern production-grade equipment.

The aim of the course is to provide students with knowledge and skills for wireless network design, operation and testing, equipment configuration, security considerations.

Course Objectives

- to familiarize students with data transfer over wireless media: digital signal modulation and coding schemes, electromagnetic waves propagation and data decoding;
- to study data link-layer protocol IEEE 802.11 (Wi-Fi): protocol design, data rates, media access control and logical link control techniques.
- to teach students to use real network equipment for wireless networks.

Learning Outcomes of the Course

By the end of the course, students will know:

- electromagnetic signal specifications
- IEEE 802.11 link-layer protocol data rates, media access control and logical link control techniques, quality-of-service and security features
- wireless network design principles

By the end of the course, students will be able to:

- perform wireless signal planning and strength measurement
- design wireless network with optimal performance
- plug in and configure wireless network equipment
- build large wireless network with centralised control
- configure wireless network security

By the end of the course, students will possess:

- the necessary skills to design, configure and operate production-grade wireless network.

Course (module) Structure

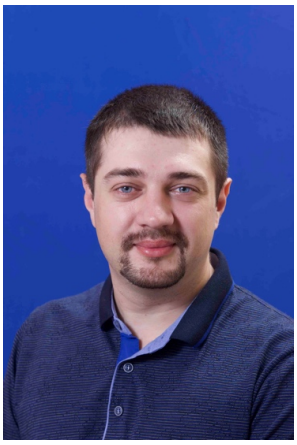
Learning Activities	Hours
Lectures	18
Practice sessions / Seminars,	18
Self-study Assignments	72
Total study hours	**108**

Detailed Schedule

Week	Lectures	Seminars/ Assignments	Hours Lec/Lab/HA
Semester 1			
1-2	Course introduction, wireless network introduction. Wireless technology history, modern wireless networks.	Lab equipment introduction. CAD tools for digital signal processing. Wireless network planning and testing software.	2/2/8
3-4	Data transfer over wireless media. Electromagnetic waves propagation. Wireless equipment and EM waves specifications. Data modulation and coding schemes, data decoding.	Wireless signal strength measurement. Wireless network design considerations.	2/2/8
5-6	IEEE 802.11 (Wi-Fi) protocol design. Wi-Fi physical layer: EM signal specifications, data rates, data modulation and coding schemes.	Example of DSSS data coding, transfer and decoding.	2/2/8
7-8	Wi-Fi data-link layer: data frame structure, media access control, wireless nodes addressing, error detection/correction.	CISCO ISR 1803 wireless router configuration example. Wireless data capture. Wireless network performance testing.	2/2/8
9-10	Wi-Fi logical link control layer: data frame types, control and management frames, multiple network coexistence. Wireless network with multiple access points, roaming.	Configuring wireless network with two access points. Familiarizing with network infrastructure. Wireless network roaming testing.	2/2/8
11-12	Wi-Fi quality-of-service (QoS) features. Frame marking, scheduling.	Configuring QoS features for wireless network.	2/2/8
13-14	Wi-Fi security features. 802.1x protocol, WPA/2/3 operation. Network infrastructure security.	Configuring security features for wireless network.	2/2/8
15-16	Wi-Fi centralised architecture. Wireless controller configuration/operation.	Configuring centralised wireless network.	2/2/8
17-18	Decentralised Wi-Fi networks (Ad-Hoc, Mesh-type). Introduction to sensor networks. Bluetooth basics.	Configuring peer-to-peer network (Wi-Fi Ad-Hoc mode or Bluetooth).	2/2/8
	18	18	18/18/72

Course Instructor(s) and Tutor(s), Contact information

Kirill V. Korshun



Current Position: Associate Professor of Computer Science Dept, School of Space and Information Technologies.
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Assessment

Assessment strategy	Points, max	Evaluation criteria
Tests	40	Test questions for lectures and self-study assignments in the e-course
Seminar works	60	Working lab example demonstration and/or lab report

Grading policy for final assessment is:

- A (excellent work) 100 points
- B (above average) 90–99 points
- C (average) 80–89 points
- D (below average) 60–79 points
- F (failed) < 60 points

Attendance Policy

Students are expected to attend classes regularly. In case of missing a seminar activity a student should perform additional self-study work and provide a report to the instructor within a week after a class was missed.

Web page of the course

Course materials and required reading materials are available on the e-course: https://e.sfu-kras.ru/course/view.php?id=32821, SibFU E-learning portal, www.e.sfu-kras.ru . You must be logged in to access this course.

Core reading

1. CWNA Certified Wireless Network Administrator Official Study Guide (ISBN: 0-9716057-2-6), McGraw-Hill/Osborne 2100 Powell St. 10th Floor Emeryville, CA 94608 U.S.A.
2. CWAP Certified Wireless Analysis Professional Official Study Guide (Exam PW0-205) First Edition. McGraw-Hill/Osborne 2100 Powell St. 10th Floor Emeryville, CA 94608 U.S.A.
3. Cisco 1800 Series Integrated Services Router (Fixed) Software Installation Guide, Cisco Systems, Inc, 2014. URL: https://www.cisco.com/c/en/us/td/docs/routers/access/1800/1801/software/configuration/guide/scg.pdf

Facilities, Equipment and Software

Software:

Matlab r2021 (free for one month), GNU Octave (free) or MathCAD PTC (free).
Wireshark (free) or similar.
InSSIDer, NetSpot or similar.

Laboratory equipment:

Cisco ISR 1803 wireless routers.
Cisco 2960, cisco 3750 ethernet multi-layer switches.
Wi-Fi capable personal device (PC, laptop, mobile phone).