Electronical Engineering
Course Syllabus

Basic Information

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	core /mandatory
Course period	1 semester from October 1st till February 1st (18 weeks)
Study credits	8 ECTS credits
Duration	288 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)

Course Overview

Description

"Electronical Engineering" is a core course.

The course starts with Ohm's Law, circuit analysis, AC, DC, amplifiers, transistors and resumes with power supply circuits, digital interfaces. This course introduces you to digital and the fundamental principles of combinational logic, logic circuit design techniques. Design and lab exercises are also significant components of the course.

Special Features of the Course

In order to facilitate learning process, a computer-aided design (CAD) software is used throughout the course. Some practical or almost actual environment problems and solutions are provided.

Course Aim

The aim of the course is to introduce the basic principles, techniques, and applications of digital electronics and to motivate and prepare students to apply them for research projects and for further study within advanced courses in professional fields.

Course Objectives

- To introduce students to basic techniques in designing and implementing complex digital systems.
- To learn basic laws of the circuits analyse theory and semiconductor devices.

- To explore the design of power supply circuits for digital electronics.
- To teach students to design in-circuit data transmission interfaces.

Learning Outcomes of the Course (module)

By the end of the course, students will know:

- how to construct of simple digital gates using transistors;
- how to use basic electronics lab equipment.

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

- analyze and construct basic analog and digital circuits.
- use numerous CAD and design tools.

By the end of the course, students will possess:

- to develop electronic products completely themselves using professional tools.

Course Structure

Learning Activities	Hours
Lectures	36
Practice sessions / Seminars,	36
Self-study Assignments	180
Final Exam (including preparation)	36
Total study hours	**288**

Detailed Schedule

Week	Lectures	Practice sessions / Assignments	Hours[1] Lec/Lab/HA
Semester 1			
1	**Circuit Analysis.** Passive Components, Ohms law, Kirchhoff's law.	The "Digital electronic" Laboratory overview. Hardware and equipment.	2/2/8
2	**Diodes** Diode equation, photodiodes, Zener diodes, LED	Using the OrCAD software for end-to-end electronic design.	2/2/8
3	**Bipolar Junction Transistor (BJT)** NPN, PNP, single-transistor amplifiers, CVC	Semiconductor electronics	2/2/18
4	**Field Effect Transistors (FET)** N-channel, P-channel, JFET, MOSFET		2/2/18
5-6	**Logic Gates** Boolean Algebra and truth Tables, NOT, AND, OR gates	Asynchronous combinational circuits	4/4/18
7-8	**Digital electronic elements** Transistor Switches, logic inverters,		4/4/18
9-10	**Data conversion circuits** Digital to analog converters (DAC), analog to digital converters (ADC)	Clocking and synchronization	4/4/20
11-14	**Power supply circuits** Transformer, rectifier, smoothing, regulator, voltage references	Power supply circuits	8/8/36
15-18	**Digital Interfaces** SPI, I2C, differential transceivers	Digital Interfaces	8/8/36
	36	**36**	**252**
36	**Final Exam**		**36**

[1] Hours designed for Classroom sessions, Web-sessions, Home Assignments etc.

Course Instructor and Tutor, Contact information

Maxim S. Medvedev,

Ph.D. in Engineering, Associate Professor of Computer Science Dept,
School of Space and Information Technologies,
Siberian Federal University.

e-mail: mmedvedev@sfu-kras.ru
Google Scholar page:
https://scholar.google.ru/citations?hl=ru&user=3ruWMfQAAAAJ

Assessment

Assessment strategy	Points, max	Evaluation criteria
Tests	30	Test questions
Lab works	40	Practical questions
Final exam	30	2 questions that require preparatory reading and knowledge of the concepts explained

Grading policy for final assessment is:

- A (excellent work) 91–100 points
- B (above average) 81–90 points
- C (average) 71–80 points
- D (below average) 50–70 points
- F (failed) < 50 points

Attendance Policy

Students are expected to attend classes regularly. In case of missing an in-lab activity a student should perform additional work submitted to the instructor within a week after a class was missed.

Every topic involves an assignment. A written report on the assignment should be submitted within two weeks from the moment students received a list of problems. The final mark will rely on the same grading policy as for the final exam.

Web page of the course

Course materials and required reading materials are available on the webpage of the course **Electronical Engeneering**, SibFU E-learning portal, www.e.sfu-kras.ru . You must be logged in to access this course. https://e.sfu-kras.ru/course/view.php?id=26697

Core reading

1. John Morris. Digital Electronics. CRC Press; September 2013. p. 132. ISBN: 9781136076862.
2. Charles Platt. Make Electronics – Learning by Discovery by (2nd Edition) Helpful Corporation, 2015. p. 349. ISBN-13: 978-1680450262, ISBN-10: 9781680450262
3. Paul Scherz. Practical Electronics for Inventors, Fourth Edition. McGraw-Hill Education. 2016. p. 1072. ISBN-13: 978-1259587542, ISBN-10: 1259587541

Facilities, Equipment and Software

Software:

OrCAD® (Cadence Design Systems);
MS Office® / Libre Office®;
Proteus Virtual System Modelling (VSM).

Laboratory equipment:

Sensors, actuators and connectors – bag.

Control, testing and measuring equipment:

Digital oscilloscopes PV6501, GW Instek GDS-8205, Tektronix TPS 2024;
Multimetr ABM-4307;
Signal generator GW Instek SFG-2010.