Program Overview - Computerized automation and robotics

Year I							
Semester I			Hours/Week				
No.	M/E	Courses	L	NE	Lab	ECTS	Teacher
1.	M	Mathematics 1	3	3	0	7	Marjan Demaj, Qefsere Gjonbalaj, Zenun Loshaj
2.	M	Physics 1	3	1	1	6	Rashit Maliqi, Skender Ahmetaj
3.	M	Fundamentals of electrical engineering	3	3	0	7	Ruzhdi Sefa, Luan Ahma
4.	M	Programming Language	2	0	2	5	Agni Dika
5.	E	Non-technical courses:					
		1.English Language	1	2	0	5	1.Qerim Spahija, Vjollca Belegu-Caka
		2.German Language	1	2	0	5	2. From UP staff
		3.Communication skills	2	1	0	5	3. From UP staff

Semester II							
1.	M	Electric Circuits	3	3	0	7	Ruzhdi Sefa, Luan Ahma
2.	M	Physics 2	3	1	1	6	Rashit Maliqi, Skender Ahmetaj
3.	M	Mathematics 2	3	3	0	7	Marjan Demaj, Qefsere Gjonbalaj, Zenun Loshaj, Shqipe Lohaj
4.	M	Algorithms and Data Structures	2	0	2	5	Agni Dika
5.	M	Digital Circuits	2	1	1	5	Agni Dika, Sabrije Osmanaj

Year II							
Semester III			Hours/Week				
Nr.	M/E	Courses	L	NE	Lab	ECTS	Teacher

1.	M	Electrical materials	2	1	1	5	Isuf Krasniqi
2.	M	Mathematics 3E	2	2	0	5	Shqipe Lohaj
3.	M	Signals and systems	3	2	0	5	Ilir Limani
4.	M	Automation	2	1	1	5	Avni Skeja
5.	M	Electronics	2	1	1	5	Myzafere Limani
6.	M	Electrical Measurements	3	0	2	5	Ali Gashi
Semester IV							
1.	M	Computer Architecture	2	0	2	5	Agni Dika
2.	M	Power Systems	3	2	0	6	Vjollca Komoni, Gani Latifi
3.	M	Electromagnetic Fields and Waves	3	0	1	6	Luan Ahma, Mimoza Ibrani
4.	M	Fundamentals of Control Systems	2	2	0	7	Avni Skeja
5.	E	Non-technical courses: 1. Management 2. Project Management	2 2	1 1	0 0	6 6	1.From Industry 2.Bernard Nikaj

Year III							
Semester V			Hours/Week				
Nr.	M/ E	Courses	L	NE	Lab	ECTS	Teacher
1.	M	Digital control systems	2	1	1	6	Lavdim Kurtaj
2.	M	Microprocessors and microcontrollers	2	0	2	6	Lavdim Kurtaj
3.	M	Programmable logic controllers	2	0	2	4	Lavdim Kurtaj
4.	E	Elective courses: 1. Sensors and actuators 2. Smart actuators and drives 3. Smart sensors	2 2 2	0 0 0	2 2 2	4 4 4	1.Arben Mashkulli, Lavdim Kurtaj 2. Lavdim Kurtaj 3. Arben Mashkulli
5.	E	Elective courses:					

		1. Communications in automation	2	0	2	4	1. Lavdim Kurtaj
		2. Computer Networking	2	0	2	4	2. Blerim Rexha
		3. Operating systems	2	0	2	4	3. Isak Shabani
6.	E	Non-technical courses:					
		1. Macroeconomics	2	2	0	6	1. From Industry
		2. Entrepreneurship	2	1	0	6	2. Bernard Nikaj
Semester VI							
1.	M	Modeling and Simulation	2	1	1	5	Ilir Limani
2.	M	Fundamentals of robotic	2	1	1	5	Lavdim Kurtaj
3.	E	Elective courses:					
		1. Nonlinear Control Systems	2	0	2	4	1.Avni Skeja
		2. Chemical Process Control	2	0	2	4	2.Arben Mashkulli
		3. Continuous and Batch Processes	2	0	2	4	3.Ilir Limani
4.	E	Elective courses:					
		1.Real-time control systems	2	0	2	4	1.From Industry
		2.Computer data acquisition and analysis	2	0	2	4	2.Lavdim Kurtaj
		3.Building automation	2	0	2	4	3.Vegim Gashi, Lavdim Kurtaj
5.	M	Internship				6	
6.	M	Bachelor thesis				6	

1.1.1. Course descriptions

Course title: Mathematics 1 (Mandatory, Sem. I, 7 ECTS)
The objective of the course: The purpose of the course is to enable students that knowledge gain through this course can apply as an auxiliary device in the professional courses of electrical engineering and computer study.
Learning outcomes: On successful completion of the course, students will be able to:
1. Know and designs to solve various problems in the field of their profession, when dealing with operations with complex numbers. Using matrices and determinants, as well as, they are able to solve and apply problems associated with systems of linear equations.
2. Understand and apply the concepts of vectors and other elements of analytical geometry in space, designs and develops these problems.
3. In research finds various electrical phenomena functional connections sizes that phenomenon of differential calculus then describes and examines them about functional, know to find their maximum values and a whole through the graphical presentation noting all properties them.
Course content. Real and complex numbers. Matrices, determinants and solving linear systems. Operations with vectors and linear combination of vectors. Scalar product of two vectors and the angle between them. Vector product, scalar triple product and vector triple product of vectors. Liner independence of vectors and basis decomposition of vectors. The functionofone realvariable, limits and its continuity. Limit of sequences. Definition of series and their convergence. Criteria for convergence of series. Derivative of a function and applications.
Methods of teaching: 45 hours of lectures + 45 hours of auditoria exercises. Approximately 120 hours of personal study and exercise.
Grading System: Homework 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. Hamiti E. - Matematika I, Prishtinë 1995.
2. Hamiti E. - Matematika II, Prishtinë 1997.
3. Peci H, Doko M. - Përmbledhje detyrash të zgjidhura nga Matematika I, Prishtinë 1997.
4. Loshaj Z. - Përmbledhje detyrash të zgjidhura nga Matematika II, Prishtinë 1996.

Course title: Physics 1 (Mandatory, Sem. I, 6 ECTS)
The goal : Using the physical laws to solve the basic problems of engineering.
Learning outcomes: 1. Analyze simple mechanical systems and solve equations of motion. 2. Apply principles of conservation of energy and momentum to particle collisions.3. Explain the conditions of statics of rigid bodies and the equation of motion for rotation of the rigid body around fixed axis. 4.Understand the first law of thermodynamics and analyze thermodynamic cycles.
Course content: The international system of Units. Physical methods, dimensions and units. Kinematics of particle, linear, rotational and curvilinear motion. Newton s laws. System of particles, center of mass, conservation of momentum. Work, energy, power. Conservative non conservative forces. Statics. Mechanics of rigid body. Gravitation. Inertial and non inertial

frames. Statics of fluids, flow of ideal and real fluids. Heat and thermometry, Kinetic theory of heat. Thermodynamics, cyclic processes, entropy.

Methods of teaching: 45 hours of lectures + 15 hours of auditorial exercises + 15 hours of laboratory exercises. Approximately 75 hours of personal study.

Grading System:

Seminar 10%, Mid-term exams 30 %, Final Exam 60 %

Literature:

1. S. Skenderi, R,Maliqi, "Physic for thechnical faculty", UP, Pristina, 2005.
2. J. Serway, Physics for scientists and engineering , Thomson Books, 2004.
3. D. Haliday, R.Resnick, J.Walker, Fundametals of Physics, John Wiley &Sons, 2001.

Course title: Fundamentals of electrical engineering (Mandatory, Sem. I, 7 ECTS)

The goal : The purpose of the course is to introduce the basic principles of electrical and magnetic field.

Learning outcomes: On successful completion of the course, students will be able to: 1. Explain fundamental laws of electromagnetism (Coulomb's, Biot-Savart, F araday's and Gauss's law). 2. Apply the fundamental laws of electromagnetism to solution of electromagnetic field problems, 3. Classify problems of electromagnetic fields into static electric, static magnetic, static current and dynamic fields. 4. Apply calculation of electromagnetic fields, inductances and capacitances to solution of practical problems. 5. Apply Matlab software for solving basic problems in both electrical and magnetic field. 6. Apply gained knowledge of electromagnetic skills in other fields

Course content: Basics of electricity, Coulomb's law and field intensity. Gauss's law. Electric potential. An electric dipole and flux lines. Electrostatic induction. Electric generator. Polarization in dielectrics. Generalized Gauss's law. Boundary conditions. Capacitance. Electrostatic networks. Energy and forces in electrostatic fields. Electrostatic field analysis using MATLAB. Basics of magnetism. Magnetic flux density. Lorentz force. Biot-Savart's law. Forces due to magnetic field. Magnetic torque and moment. Ampere's law. Magnetic dipole. Magnetization in materials. Generalized Ampere's law. Magnetic boundary conditions. Magnetostatic field analysis using MATLAB. Faraday's law. Inductors and inductances. Magnetic energy. Magnetic circuits.

Teaching Methodology: 45 hours of lectures + 45 hours of tutorials. Approximately 70 hours of personal study and exercise including seminars.

Grading System: First assesment:30%, Second assessment: 25%, Home exercises 10%, Attendance: 5%, Final exam, 30%, Total:100%

Literature:

1. Nexhat Orana, *Bazat e elektroteknikës 1*, Prishtinë, 1994
2. Nexhat Orana, *Bazat e elektroteknikës 2,* Prishtinë, 1994
3. M.N. *Sadiku, Elements of electromagnetic*, Oxford University Press, New York, 2001

Course title: Programming Language (Mandatory, Sem. I, 5 ECTS)
The goal : The purpose of the course is to introduce the basic principles of programming and algorithms, for solution of problems with computer and writing of respective programs in C++ programming language.
Learning outcomes: On successful completion of the course, students will be able to write programs in C++ programming language, including the use of different functions.
Course content: Introduction to algorithms: sum, product and factoriel. Array operations and algorithms: sum/product of the array members, counting members, searching and sorting. Matrix manipulations: creation, sum/product of the members, searching, creationg vector from the matrix members. Introduction to C++ programming language: variable types, operators, statements. Input and output: input of numbers, arrays, strings and their output, use of manipulators. Branching: if, goto, switch( ). Loops: while, do-while, for. Loops: breaking, continuing and exiting. Functions: defining and executing, parametters and arguments, mathematical and string functions. Using vectors and matrices with functions. Recursion, pointers, references. User defined types: enumerations, structures, classes.
Methods of teaching: 30 hours of lectures + 30 hours of auditorial/lab exercises. Approximately 100 hours of personal study and exercise including home problems/tasks.
Grading System: Attendance 10%, Mid-term problems 30 %, Collocui/Final Exam 60 %
Literature:

1. Agni Dika, "Algoritmet, me programe në C++", Universiteti i Prishtinës, Fakulteti Elektroteknik, Prishtinë, 2004, http://www.agnidika.net/algoritmetCpp.pdf
2. Agni Dika Bazat e Programimit në C++, Universiteti i Europës Juglindore, Tetovë, ISBN 9989-866-23-6, http://www.agnidika.net/programimiCpp.pdf
3. H.M. Deitel, P. J. Deitel, How to Program C++, Prentice Hall, Upper Saddle River, New Jersey, ISBN 0-13-111881-1
4. Robert Lafore, Object-Oriented Programming in C++, Sams, Indianopolis, Indiana, ISBN-10:0-672-32308-7

Course title: English Language (Elective, Sem. I, 5 ECTS)
The goal: The aim of the course is to develop students' communication skills inEnglish Language, in both oral and written form,with special focus in the field of electrical and computer engineering.
Learning outcomes: Upon successful completion of this course students will be able:1. To apply active English Language in their everyday life; 2. To communicate in English Language in both oral and written form at appropriate level, primarily in their professional field of study; 3. To ask and respond questions from the field of electrical and computer engineeringin English Language; 4. To translate texts from the field of electrical and computer engineering.
Teaching methodology: 15 hours lectures, 30 hours exercises. Approximately 100 hours of independent work including the seminar paper.
Assessment: Seminar paper 10%, intermediate assessment 30 %, final exam 60 %
Basic literature:

1. Markovic, Jelica, *Engleski jezik za studente elektrotehnickog fakulteta*, Beograd, 1989
2. D. Nastić, V. Kosovac: "Engleski jezik za elektrotehnicke i masinske fakultete", Svjetlost Sarajevo, 1984.

Course title: Communication skills (Elective, Sem. I, 5 ECTS)
The goal: The goal of this course is to develop *written and verbal communication skills* and group work.
Learning outcomes: On successful completion of the course, students will be able to:
1. write different official and business letters; 2. write formal and informal emails; 3. write a five-paragraph essay; 4. write different reports (visit r., field r., feasibility r., progress r.); 5. write laboratory reports; 6. use the Internet to find specific information; 7. use the computer to write different reports; 8. write minutes of meetings; 9. write a paper on a particular problem or issue; 10. write CVs and applications for work; 11. hold oral presentations; 12. respond to job interviews.
Course content: Introduction to communication skills. Words and sentences. Writing process. Technical information. Internet information and e-mail: World Wide Web (www). Essays and exam answers. Laboratory reports. Reports. Proposals, specifications and manuals. Final year projects and reportss. Spoken presentations. Group work and meetings. Letters. CVs and job applications. Interviews: Interview for job.
Methods of teaching: 30 hours of lectures + 15 hours of exercises. Approximately 100 hours of personal study and exercise including home-work.
Grading System: 1st Exam: 25%; 2nd Exam: 25%; 50%, Home-work: 25 %, Final exam: 25 %
Literature:

1. Majlinda Nishku, *Si të shkruajmë: procesi dhe shkrimet funksionale*, CDE, Tiranë, 2004.
2. Rami Memushaj, *Shqipja standarde. Si ta flasim dhe ta shkruajmë.* Toena, Tiranë, 2004.
3. Bardhyl Musai, *Si të shkruajmë ese*, CDE, Tiranë, 2004.
4. John W. Davies, *Communication Skills. A Guide for Engineering and Applied Science Students*, Prentice Hall, 2001.

Course title: Electric Circuits (Mandatory, Sem. II, 7 ECTS)
The goal: The purpose of the course is to introduce the basic principles of electrical circuits.
Learning outcomes: On successful completion of the course, students will be able to: 1. Understand and apply Kirchhoff's Laws to DC and AC circuit analysis. 2. Understand and apply phasors for sinusoidal steady-state AC circuit analysis 3. Analyze DC and AC circuits by following circuit analysis methods and theorems (nodal analysis, mesh analysis, star-delta transformation, transformation between real source models, Millman's, Thévenin's and Norton's theorems 4. Understand and apply the principle of linearity and superposition to AC and DC circuits 5. Analyze transient response of first order circuits (series RC and RL). 6. Use software PSPICE for solving DC and AC circuits. 7. Apply gained knowledge of electric circuit skills in other fields
Course Content: Concepts, elements and topology of electric circuits**.** – Types of electrical circuits. Elementary DC circuits – Circuit Elements, Electrical resistance- Ohm’s law. Construction of circuitmodel.Voltage and potential in electric circuit. Current source. Kirchoff’s laws. Analysis of a Circuit Containing Dependent Sources. Complex DC circuits. DC circuit analysis using SPICE. Current and voltage waveforms. Techniques of Circuit Analysis.

Sinusoidal Steady-State Analysis. The Sinusoidal Response, The Passive Circuit Elements in the Frequency Domain, Sinusoidal Steady-State Power Calculations, Maximum Power Transfer. AC circuit analysis using SPICE. Magnetically coupled circuits. Response of First-Order *RL* and *RC* Circuits. Transient circuit analysis using SPICE. Balanced Three-Phase Circuits. SPICE analysis of three phase circuits.

Teaching methodology: 45 hours lectures, 45 hours tutorials, and approximately 70 hours independent work.

Assesment: First assesment:30%, Second assesment: 25%, Home work 10%, Attendance: 5%, Final exam, 30%, Total:100%

Literature :

1. Nexhat Orana, *Bazat e elektroteknikës 1*, Prishtinë, 1994
2. Nexhat Orana, *Bazat e elektroteknikës 2,* Prishtinë, 1994
3. Ch. Alexander, M. N. Sadiku, Electric circuits, McGraw Hill, New York, 2000

Course title: Physics II (Mandatory, Sem. II, 6 ECTS)

The goal: Using the physical laws of modern physics in modeling and solving specific engineering problem.

Learning outcomes: On successful completion of the course, students will be able to: 1. Apply the linearization technique to equations of motion of oscillatory 2. Explain the wave equation in non dispersive medium 3. Analyze optical systems using the methods of geometrical optics.4 . Explain the phenomena of interference, diffraction and polarization of light.5. Explain Planck's law of black body radiation. 6. Relate the atomic spectrum to quantization of energy levels.

Course content: Solid state materials elasticity. Mechanical oscillation and mechanical waves. Sound waves. Doppler s effect. Electromagnetic waves. Maxell s equation s. Wave equation, wave propagation. Geometrical optics, mirrors, lenses and prisms. Physical optics. Interference, diffraction and polarization. Photometry. Quantum nature of light. Blackbody radiation, quantization. Photo effect and Compton s effect. Atom structure. Atomic specters. X-rays. Atomic nucleus. Radioactivity. Relativistic mechanics.

Methods of teaching: 45 hours of lectures + 15 hours of auditorial exercises + 15 hours of laboratory exercises. Approximately 75 hours of personal study.

Grading System: Seminar 10%, Mid-term exams 20 %, Final Exam 60 % .

Literature:

1. S. Skenderi, R,Maliqi, "Physic for thechnical faculty", UP, Pristina, 2005.
2. J. Serway, Physics for scientists and engineerings, Thomson Books, 2004.
3. D. Haliday, R.Resnick, J.Walker, Fundametals of Physics, John Wiley &Sons, 2001.

Course title: Mathematics 2 (Mandatory, Sem. II, 7 ECTS)

The goal: The purpose of the course is to enable students to knowledge gained through this course can apply as an auxiliary device in the professional courses of study electrical engineering and computer.

Learning outcomes: On successful completion of the course, students will be able to: 1. Understand the notion of indefinite integral and definite integral and their application in the computation of various measures in geometry, electrical engineering, mechanics and other areas; 2. Understand basic techniques in calculus of several variables and apply on finding local and global extremes of differentiable functions of several variables; 3. Relate techniques of Mathematics and use them to solve basic types of ordinary differential equations and create a mathematical model, based on the differential equation, related to electrical engineering.
Course content. Indefinite and definite integral. Methods of integration (method of substitution and integration by parts). Applications of integral calculus. Function of several variables, Euclidean space R^n. The notion of the graph of the function in several variables. Limit and continuity of functions in several variables. Partial derivatives. Higher order derivatives. Derivatives of composite functions and chain rule. Local extreme of function of several variables. First-order differential equation. Orthogonal trajectories. Singular solutions of differential equations of the first order. Linear differential equation of the second order. Higher-order linear ordinary differential equations with constant coefficients. Linear systems of two or more ordinary differential equations
Methods of teaching: 45 hours of lectures + 45 hours of auditoria exercises. Approximately 120 hours of personal study and exercise.
Grading System: Homework 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. Hamiti E. - Matematika II, Prishtinë 1995.
2. Hamiti E. - Matematika III, Prishtinë 1997.
3. Loshaj Z. - Përmbledhje detyrash të zgjidhura nga Matematika II, Prishtinë 1996.
4. Hamiti E., Lohaj Sh. – Matematika III – Përmbledhje detyrash, Prishtinë 1998.

Course title: Algorithms and Data Structures (Mandatory, Sem. II, 5 ECTS)
The goal : The purpose of the course is to help studens in advancing their knowledge for different algorithms, data structures and use of classes and objects in programming.
Learning outcomes: On successful completion of the course, students will be able to compile advanced algorithms, to define structures and classes and to use them in writing advanced programs.
Course content: Definition and use of advanced functions, iline functions, macro functions, function overloading, templates. Searching and sorting algorithms: different methods for searching and sorting.
User defined types. Object oriented programming: classes and objects. Classes and member functions. Using public and private members. Declaring objects and operating with their components. Pointers and functions with pointers. References and functions with references. Stack. Queue. Linked lists, adding/deleting members. List searching and sorting. Binary tree. Graphs. Files: sequential and direct access files.
Methods of teaching: 30 hours of lectures + 30 hours of auditorial/lab exercises. Approximately 100 hours of personal study and exercise including home problems/tasks.
Grading System:
Attendance 10%, Mid-term problems 30 %, Collocui/Final Exam 60 %
Literature:

1. Agni Dika, Programimi i Orientuar në Objekte, me programe në C++, UEJL, Fakulteti i Shkencave Bashkëkohore, Tetovë, ISBN 9989-866-25-2, http://www.agnidika.net/programimiobjekte.pdf
2. D. S. Malik, C++ Programming: Program Design Including, Data Structures, Course Technology, Thomson Leraning, Boston, Massachusetts, ISBN 0-619-03569-2
3. H.M. Deitel, P. J. Deitel, How to Program C++, Prentice Hall, Upper Saddle River, New Jersey, ISBN 0-13-111881-1
4. Robert Lafore, Object-Oriented Programming in C++, Sams, Indianopolis, Indiana, ISBN-10:0-672-32308-7
5. D. S. Malik, Programming: From Problem Analysis To Program Design, Course Technology, Thomson Leraning, Boston, Massachusetts, ISBN 0-619-06213-4

Course title: Digital Circuits (Mandatory, Sem. II, 5 ECTS)
The goal: The purpose of the course is to present the way of digital logic design (analysis and design).
Learning outcomes: On successful completion of the course, students will be able to: 1. Explain and find the functions that performs a digital logic circuit. 2. To formulate differnet codes for information. 3. To express values in different system: Binary, Octal, Hexadecimal,etc. 4. Analyze logic circuits. 5. Designing the digital circuits.
Contents: Numerical systems. The binary number system, arithmetic operations in the binary system. Transformations between systems. Codes and encoding. Boolean algebra. Logical functions and their presentation. Combinatorial logic circuits. Analysis of logic circuits. Synthesis of logic circuits. Encoders, decoders, codes transducers, multiplexers, demultiplexers, arithmetic circuits, comparators, ROM memories. Digital sequential circuits. Flip-Flops: SR, JK, D, T. StateTables of the circuits. Diagram of states of the circuit. Analysis of synchronous sequential circuits. Analysis of asynchronous sequential circuits. Design of sequential circuits. Design of digital counters. Design of memory. Software for simulating logic circuits.
Methods of teaching: 30 hours of lectures + 15 hours of auditorial exercises and 15 hors of laboratory exercises. Approximately 70 hours of personal study and exercise including projects.
Grading System: Presence 10%, Projects 30 %, Final Exam 60 %
Literature:

1. Agni Dika "Qarqet digjitale kombinuese I", Universiteti i Prishtinës, 2008
2. S.M. Deokar, A. A. Phadke, "Digital Logic Design and VHDL", Wiles, 2009

Course title: Electrical Materials (Mandatory, Sem. III, 5 ECTS)
Objectives of the course (module): As students gain knowledge of the basic features of materials used in engineering and dependency features their effects of external field's forms.
Learning outcomes: After completing this course (course) the student will be able to: 1. To enrich knowledge Micro structure of materials. 2. To enrich knowledge of the basic features of conductive materials, dielectric and magnetic and 3. To be able to make quality selection of materials depending on the electro influences of various external fields.

Contents: Basic knowledge on materials microstructure. Conductive materials, materials with greater conductivity, semiconductor materials and super-basic features and their characteristics. Materials and their dielectric and magnetic materials, basic features and their use. Experimental Determination of the basic characteristics of materials, conductors, and magnetic insulation

Methodology of teaching:(30 hours of lectures, 30 hours of laboratory exercises. Approximately 100 hours of independent work including elaborations processing of experimental data.

Evaluation: Evaluation of the first 15%, second 15% rating, the third rating 15%, 5% Regular attendance, final exam 50%.

Literature:

1. A. Abbas, I. Krasniqi: "Materialet elektroteknike" Pristine, 1997
2. A. Robert: "Dielectric Materials and application", London, 1995,
3. D.G. Fink, H.W. Beaty, "Standard Handbook for Engineers ELECTRICAL" Mc. Graw Hill, N.Y, 1995

Course title: MathematicsIII(E) (Mandatory, Sem. III, 5 ECTS)

The goal: Is to enable students that knowledge gain through this course can apply as an auxiliary device in the professional courses of electrical engineering and computer study.

Learning outcomes: On successful completion of the course, students will be able to: 1. Formulate and to solve various problems in the field of their profession, when dealing with double, triple, line and surface integrals, vector functions in the space, scalar and vector fields and Fourier series. 2. The student will know to describe and solve problems related to the mechanics and the theory of electrical circuits. With the acquired knowledge the student will be trained to make mathematical models related to specific professional problems.

Course content: Double and triple integrals, definition, calculation and their application in mechanics. Line integral of the first type and the second type, their definition, calculation, and Green's formula. Surface integral of the first type and the second type, their definition, calculation, Stocks and Gauss-Ostrogradsky formula. Vector functions in space. The gradient of the scalar field. The divergence and rotor of the vector field. Fourier series. Dirichlet conditions. Parseval identtity. Fourier series of the complex forme. Fourier transformations and Fourier Integral. Classical and axiomatic definition of probability. Events. Random variables and their distribution. Mathematical expectation, variance, standard deviation and other moments.

Methods of teaching: 30 hours of lectures + 30 hours of auditoria exercises. Personal study and exercise, discussions and group and individual consultations.

Grading System: Homework 10%, Mid-term exams 30 %, Final Exam 60 %

Literature:

1. Hamiti E. - Matematika III/1, Prishtinë 1995.
2. Hamiti E. - Matematika III/2, Prishtinë 1997.
3. HAMITI E, LOHAJ SH. - Përmbledhje detyrash të zgjidhura nga Matematika III, Prishtinë 2001.
4. HAMITI E, LOHAJ SH. - Përmbledhje detyrash të zgjidhura nga Matematika IV, Prishtinë 2002

Course title: Signals and Systems (Mandatory, Sem III. , 5 ECTS)
Course objectives: The objectives of the course are to introduce students to the basic concepts of signals, system modeling, and system classification; to develop students' understanding of time-domain and frequency domain approaches to the analysis of continuous and discrete systems; to provide students with necessary tools and techniques to analyze systems; and to develop students' ability to apply modern simulation software to system analysis.
Learning outcomes: Student will learn properties of signals and systems and the ways how to represent them in time and frequency domain. After finishing the course student will be familiar with fundamental methods of signal and system analysis, in time and transform domain, through problem solving and performing corresponding simulations.
Course content: Introduction to basic theoretical concepts of signal and systems. Impulse response and convolution. Differential and difference equations. Fourier series and signal decomposition in harmonic components. Fourier transformation, spectrum of continuous signal and its properties. Amplitude modulation and sampling. System analysis in the frequency domain. Ideal filters. Demodulation and reconstruction of sampled signals. Fourier analysis of signals and systems in discrete time. Laplace transformation and its applications in the analysis of signals and systems. z-transform, properties, transfer function, stability and analysis in z domain.
Teaching methodology: 45 hours of lectures + 30 hours of exercises. Approximately 75 hours of personal study, including homework exercises.
Grading System: Homework 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. "*Schaum's Outline of Theory and Problems of Signals and Systems*", Hwei P. Hsu, 1995, McGraw-Hill.
2. "*Signals and Systems*", Alan V. Oppenheim, et al, 2nd ed., 1996, Prentice Hall.
3. "*Fundamentals of Signals and Systems-Using Matlab*", E. Kamen and B. Heck; 3rd ed., 2006, Prentice Hall.

Course title: Automation (Mandatory, Sem. III, 5 ECTS)
The goal : The purpose of the course is to introduce the students with the concepts and fundamental structures of automatic control systems.
Learning outcomes: On successful completion of the course, students will be able to: 1. To be thoroughly familiar with the concept and standard structures of automatic control systems. To appreciate the importance of feedback in system performance. **2.** Write dynamic equations of automatic systems, obtain a mathematical model of different control systems 3. Become familiar with the modeling of systems in the form of block diagrams and obtain transfer functions from such structures. 4.Perform system analysis in time domain and frequency domain 5. Conclude on important features of control systems based on the analysis of time and frequency responses.

Course content: Introduction to the fundamental of automatic control. The necessary mathematical apparatus for analysis of control systems. Mathematical modeling of electrical, mechanical and thermal systems. Time domain analysis of control systems. Step response of control systems and data inferring from recorded responses. Frequency domain analysis of control systems. Bode and Nyquist diagrams; deriving system features from these diagrams. Modeling and analysis of systems in state space. Controllability, observability and feedback controllers.
Methods of teaching: 30 hours of lectures + 15 hours of auditorial exercises + 15 hours of laboratory exercises. Approximately 100 hours of personal study and exercise including seminars.
Grading System: Seminar 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. F. Golnaraghi & B. C. Kuo, *Automatic Control Systems*, John Wiley & Sons
2. J. D'Azzo & C.Houpis, *Automatic Control Systems, Analysis and Design. Conventional and Modern*. McGraw Hill
3. A. Skeja, *Rregullimi Automatik,* Ligjwrata tw autorizuara

Course title: Electronics (Mandatory, Sem. III, 5 ECTS)
The goals: To provide an introduction to basic concepts in the field of electronics. This course is one of the fundamental courses for all departments of electrical engineering and will prepare students for more advanced courses in the field of electronics.
Learning outcomes: Upon completion of this course the student will be able to: Understand the basics of electronics within the field of electrical engineering, to analyze and design the diode circuits, bipolar and FET transistor and their models; analyze and design transistor circuits for small signals, analyze and utilize operational amplifiers, will be able to continue studies in advanced electronic courses and electrical circuits.
Course content: Basic concepts, current voltage, Kirchhoff's laws, Norton's theorem and Thevenin's theorem. Ac circuits, resonance, transfer function, four pole networks, filters and amplifiers. Diodes circuits, zener diodes, drivers, and diodes circuits for signal processing. Bipolar transistors, the basic configuration bipolar transistor circuits, models for small signals. Basic amplifier configurations: common Emitter, common based and common collector. Field effect transistor, operational principles, models for small signals. MOSFET transistors. Basic amplifier configurations: common sours, common gates and common drain. Operational amplifiers, real and ideal characteristics, basic circuits with operational amplifiers, AO applications. Feedback elements, differential amplifier. Data acquisition and control processes, comparators, oscillators, A/D transducers D/A transducers, time conversion. Computers and interconnection circuits.
Methods of teaching: 30 hours of lectures + 15 hours of auditorial exercises + 15 hours of laboratory exercises. Approximately 100 hours of personal study and exercise.
Grading System: Test 1: 15 % , Test 2: 15 % Final test: 20%, Final exam: 50%
Literature:

1. Donald Neamen, Electronic Circuit Analysis and Design, McGraw-Hill Education, 2000,

2. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, 2007,
3. Myzafere Limani, Elektronika, Universiteti i Prishtinës, ligjërata të autorizuara, 2008.

Course name: Electrical Measurements (Mandatory, Sem. III, 5 ECTS)
Course objectives: To achieve the basic theoretical and practical knowledge's about Electrical Measurements.
Learning Outcomes: After completion of this course, student should be able to use instruments and measuring methods for measuring of electrical, nonelectrical and magnetic quantities. He should be able to do this in professional engineering and scientific manner estimating the measurement uncertainty of measured result. The covered span of measured quantities is that used utilities in industries and research without special measurements, i.e. student should have knowledge's about: sensors, instruments, amplifiers and converters of quantities.
Course Content: Measuring *units* and *measuring errors*. The use of resistor combinations to build measuring schemes for: *voltage-potentiometers* and current *dividers*, *measuring potentiometers* and *measuring bridges*. Discus and use the: *thermocouples, resistive temperature detectors, thermistor's for temperature measurements, and strain gauge resistors to measure mechanical tension*. Discus and use of different *sensors: capacitive, inductive, magnetic and electromagnetic and induction type*, for different *measurements of physical quantities*. Knowledge and ability to use methods and instruments to measure *electrical quantities as: voltage and current (both ac and dc), resistance, impedance and reactance; power and energy (both dc and ac in single and three phase system*. Discus and use methods and instruments to *measure magnetic quantities: flux, flux density, intensity of magnetic field and magnetic losses in ferromagnetic material*.
Teaching methodology: 45 hours lectures with solution of problems, and 30 hours laboratory work. Approximately 75 hours with lecturer and teaching assistant.
Assessments: 3 tests each one 15 %, laboratory work test 15% and final exam 40 %.
Literature:

1. A. Gashi, Matjet elektrike, ligjëratat dhe prezantimet 2012.
2. M.J. KORSTEN, W.OTTHIUS, F. VAN DER HEIJDEN "Measurement Science for Engineers, Elsevier Science & Technology Books, 2004.
3. M. SEDLÁČEK, V. HAASZ, Electrical Measurements and Instrumentation, Prague 2000.

Course title: Computer Architecture (Mandatory, Sem. IV, 5 ECTS)
The goal: The purpose of the course is to introduce computer architecture and organization, their structure and function.
Learning outcomes: On successful completion of the course, students will be able to:
1.Explain the evolution of computers, their development over generations, the bus system, all types of memories, Input/Output modules, instructions, addressing mode, addressing formats,designing and construction of modern processors. 2. To be able to write and execute

programs in Assembler language, using registers. 3. To be able to evaluate the performance of a computer. 4. To know the requirements and design parameters of the processor, memory and computers in general.

Contents: The evolution of computers. The performance of computers. Top Level View - Buses. Cache memory. Internal memory technology. External memory. Input / Output Modules. Computers arithmetic. Assembler language. Mikroprogramming. Instruction sets. Addressing modes and formats. Prosessor structure and function. Reduced Instruction Set Computers (RISCs).

Methods of teaching: 30 hours of lectures + 30 hours of auditorial and laboratory exercises. Approximately 80 hours of personal study and exercise including projects.

Grading System: Presence 10%, Projects 30 %, Final Exam 60 %

Literature:

1. Williams Stallings "Computer Organization and Architecture – Designing for Performance", 8^{th}Edition, Prentice Hall, 2010
2. Linda Null and Julia Lobur, "The essentials of Computer Organization and Architecture", Jones and Bartlett Publishers, 2003.

Course title: Power Systems (Mandatory, Sem. IV, 6 ECTS)

The goals: The purpose of the course is to introduce the basic principles of operation of the power system and electrical machines.

Learning outcomes: On successful completion of the course, students will be able to:

1. Have knowledge of the power system, its components (power plants, transmission and distribution networks, substations). 2. Have knowledge of transformers, operating principle, equivalent schemes, types of transformers and their application. 3. To know the principles of energy conversion and operating principle of the DC Machines. 4. To recognize principles of operating of AC machines with special emphasis on induction motors and synchronous generator.

Course content: Power System and its component parts. Power plants, transmission and distribution system. Thermal power plants, nuclear power plants, hydro power plants, wind power plants, solar plants. Single-phase and three-phase circuits analysis. Cables. Transmission lines. Principles of energy conversion. The operating principle of transformer, equivalent schemes, determination of transformer parameter. The operating principle of the DC Machines. Types of excitation. Control of voltage and speed. Models of AC machines. The operating principle of induction machines. Equivalent schemes, the induced voltage, torque and starting of induction motor. The operating principle of synchronous machine.

Methods of teaching: 45 hours of lectures + 30 hours of auditoria exercises. Approximately 100 hours of personal study.

Grading System: First exams 20%, Second exams 20 %, Final Exam 60 %

Literature:

1. George G. Karady & Keith Holbert, *Electrical Energy Conversion and Transport*, John Wiley,2005.
2. Guru, B.S and Hiziroglu, H.R. *Electric Machinery and Transfoermers*, Oxford Universitz Press, New York- Oxford 2001.
3. Gani Latifi, **Shndërrimi i energjisë elektrike**, Prishtinë 1997

4. Vjollca Komoni, Gani Latifi **Elektronenergjetika**, ligjëratat, Prishtinë 2008

Course title: Electromagnetic Fields and Waves (Mandatory, Sem. IV, 6 ECTS)

The goal: To provide students with the background necessary to understand the interplay between electricity and magnetism, the electromagnetic wave properties and its propagation in different media through various junctions.

Learning outcomes: On successful completion of the course, students will be able to: 1. Apply vector calculus to analyze the behavior of static electric fields and magnetic fields in standard configurations; 2. Describe the parameters of quasistatic and time varying fields, guided and free space wave propagation and the underpinning role of Maxwell's equations. 3. Explain examples of the interaction between waves and media and to be able to relate these to engineering design considerations and function; 4. Illustrate and analyze transmission lines; 5.Practice calculation of electromagnetic filed to solution of practical problems.

Course content: Vector Analysis: Gradient, Divergence and Curl, Laplacian operator.

Electrostatics: Maxwell's equations, Charge and current distributions, Gauss Law, Electrical scalar potential, Electrical properties of materials, Method of images, Electrostatic potential energy.

Magnetostatics: Magnetic forces and torques, Maxwell's magnetostatic equations, Vector magnetic potential, Boundary conditions, Inductance, Magnetic energy. Maxwell's equation for time varying fields: Faraday Law, Displacement current, Retarded potentials. Electromagnetic Waves: Derivation of the wave equation, solution of wave equation for TEM case, plane wave concepts, wavelength, attenuation and phase constants, propagation of waves in lossless and lossy media. Transmission Lines: Derivation of transmission line parameters, attenuation and phase coefficients, characteristic impedance, SWR definition, lossless and lossy lines and matching techniques.

.**Methods of teaching:** 45 hours of lectures + 15 hours of combined auditorial and laboratory exercises. Approximately 80-90 hours of personal study and exercise including assignments.

Grading System: Assignment 15%, Mid-term exam 35 %, Final Exam 50 %

Literature:

1. Fawwaz T. Ulaby, Eric Michielssen and Umberto Ravaioli, "Fundamentals of Applied Electromagnetics" Prentice Hall 6th Edition, 2010
2. Magdy F. IIskander "Electromagnetic Fields and Waves ", Waveland Press, 2012

Course title: Fundamentals of Control *Systems* (mandatory, Sem. IV, 7 ECTS)

The goal : The purpose of the course is to introduce the students with the impotant concept of controllers and become capable to use the different techniques to tune the controllers.

Learning outcomes: On successful completion of the course, students will be able to: 1. To fully understand the concept of controller and their influence in the general performance of control systems.. 2. Use different methods of designing controller in the time and frequency domain. 3. Analyze unstable systems and the improvement of their performance by integrating the controller in the control system structure. 4.Notice the relation between designing controllers in time and frequency domain 5. Introduction to controller design in state space.

Course content: Transfer function analysis and the influence of pole/zero position on the system response. Stability system through Routh-Hurwirz method and Mihajlov criterion. Introduction to the concept of controllers and their influence of the quality of system dynamic response. Techniques for designing controller in time and frequency domain. Controller tuning to achieve time specification. Using Bode diagrams to design controllers in the frequency domain to achieve the desired level of phase margin and steady state error. Controller design using the root locus method. Introduction to controller design in state space.
Methods of teaching: 45 hours of lectures + 15 hours of auditorial exercises + 15 hours of laboratory exercises. Approximately 100 hours of personal study and exercise including seminars.
Grading System: Seminar 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. F. Golnaraghi & B. C. Kuo, *Automatic Control Systems*, John Wiley & Sons
2. J. D'Azzo & C.Houpis, *Automatic Control Systems, Analysis and Design. Conventional and Modern*. McGraw Hill
3. A. Skeja, *Bazat e Rregullimit Automatik,* Authorized Lecture Notes

Course Title : Project Management (Elective, Sem IV, 6 ECTS)
Course/Module aim: This module aims to introduce students to the basic concepts of project management and offer them the opportunity that through practice they apply these concepts.
Expected results : At the end of this course, students will be able to:
Identify projects and distringuish them from other activities in the organization. Understand the importance of project planning and activities required for good planning. Understand the complex natyre of managing project activities. Use different techniques for project management (such as PERT). Identify required skills for a good project manager. Understand concepts of project costs, project budgets and activities required for their management. Identify and manage project risks. Understand the importance of project audit and monitoring.
Course contents: Introduction to project management. Project phases and life cycle. Project team management. Cost and time planning. Project planning and scheduling. Resource alocation. Risk Management. Project monitoring and control. Project auditing.
Teaching methodology: 30 hours of lectures and 30 hours of practice. Approximately 100 hours of independent work including term presentation.
Grading: Presentation 20%, Wikipedia project 10 %, Final exam 70 %
Literature :

1. Suzana Panariti: Menaxhimi i Projekteve, Shtëpia Botuese e Librit Universitar 2010, Tirane
2. Clifford F. Gray, Eric W. Larson: Project Management, The managerial Process, McGraw-Hill, 2006
3. Denis Lock: Project Management, Gower Publishing Limited, 2008

Course title: Digital control systems (Mandatory, Sem. V, 6 ECTS)
The goal: Familiarity with concepts of digital control. Familiarity with structure of digital control systems. Familiarity with analysis and design methods for digital control systems. Implamentation of microprocesorik digital controllers, hardware and software part. Familiarity with advanced digital control devices.
Learning outcomes: On successful completion of the course, students will be able to: 1. understand digital control systems; 2. evaluate performances of digital control systems and be able to take necessary measures to improve them; 3. design microprocessor based system for implementing digital controller; 4. write software support for implementing digital controllers; 5. get involved in streams of advanced digital control.
Course content: Introduction to the subject. Examples of discrete and digital control. Signal conversion and processing. Typical digital sensors. Connection with actuators. Step-motors. Structure of digital control systems. Modeling. z-Transform. Modified z-transform. Signal between sampling instants. Transfer function, block diagram and signal flow graphs. State variable method. Controllability, observability and stability. Time domain and z domain analysis. Frequency domain analysis. Digital simulation and digital redesign. Cascade compensation with digital controller equivalent to continuous one. Digital controllers. Root locus in z plane. Implementation of digital control systems. Software implementation of digital controllers. Finite word length. Digital signal processors (DSP).
Methods of teaching: 30 hours of lectures, 15 hours of auditory exercises, 15 hours of laboratory exercises.
Grading System: Mid-term exams 15%+15%, Lab work 20%, Final exam 30%+20%.
Literature:

1. B.C. Kuo, *Digital Control Systems*, Saunders College Publishing, Florida
2. C.H. Houpis, G.B. Lamont, *Digital Control Systems: Theory, Hardware, Software*, McGraw-Hill, New York
3. R.C. Dorf and R.H. Bishop, *Modern Control Systems*, Prentice Hall, 2005
4. G.F. Franklin, J.D. Powell, and M. Workman, *Digital Control of Dynamic Systems*, Addison Wesley, 3rd Ed., 1998
5. G. C. Goodwin, Stefan F. Graebe and M. E. Sagado, *Control System Design*, Prentice-Hall, Inc., 2001

Course title: Microprocessors and microcontrollers (Mandatory, Sem. V, 6 ECTS)
The goal: Familiarity with parts of computer harware. Uses of microprocessors/microcontrollers in different applications. Basic microcontrollers concepts. Familiarity with architecture of 8051 family of microcontrollers. Familiarity with software development systems. Microcontroller programming in assembler, C and Basic. Programming and utilization of peropheral devices.
Learning outcomes: On successful completion of the course, students will be able to: 1. know structure of microprocessor systems that are faced with 2. design microprocessor and microcontroller based systems for specific application; 3. write program for specific application; 4. find and repair defects in microprocessor systems.
Course content: Motivation and introduction to microprocessor systems. Logical circuit and microprocessor system design. Microprocessor systems and details abut communication between

units, time diagrams. Internal structure of 8051 and variations among different producers. Introduction to development system. Instruction set. Input/output ports and communication with peripherals. Programming in assembler. Keyboard and display. Program structure. State diagrams. Timer function and programming. Interrupts - generation and processing. Serial communication. A/D and D/A conversion. Programming in higher level languages, C, Basic, Pascal.

Methods of teaching:30 hours of lectures, 30 hours of laboratory exercises.

Grading System: Mid-term exams 10%+10%, Project 40%, Final exam 20%+20%.

Literature:

1. D. V. Hall, *Microprocessors and digital systems*, McGraw-Hill
2. S. MacKenzie, *The 8051 microcontroller*, Prentice-Hall
3. Kenneth J. Ayala, *The 8051 microcontroller: Architecture, Programming and Applications*, West Carolina University, 1991
4. David Calcutt, Fred Cowan, Hassan Parchizadeh, *8051 Microcontrollers: An Applications-Based Introduction*, Newnes, 2004
5. Muhammed Ali Mazidi, *The 8051 Microcontroller And Embedded Systems Using Assembly And C*, Pearson Education, 2007

Course title: Programmable logic controllers (Mandatory, Sem. V, 4 ECTS)

The goal: Familiarity with programmable logic controllers (PLC). Familiarity with using PLCs in automation. Familiarity with methods for crating programs for PLCs. Implementation of a project based on PLC - procedure from idea to hardware and software implementation. Familiarity with advanced structures: modules, network, and human-machine communication.

Learning outcomes: On successful completion of the course, students will be able to: 1. know PLC based systems in general; 2. know types of sensors and actuators and how to connect them to PLC; 3. select proper PLC system for solving automation problem; 4. program PLC starting from standard problem specification by using basic functions and advanced one; 5. present knowledge on PLC communication possibilities and on human-machine communication.

Course content: Introduction to the course. Automaton chronology. Programmable logic controller (PLC) structure. Types of pLCs. Siemens PLCs: LOGO and S7-200. Basic PLC programming. Programming software. Wiring schematics. Functional blocks and ladder diagram. Sensors with logical/digital output. Logical/digital input modules. Wiring sensors to input modules. Actuators and their logical/digital control. Logical/digital output modules. Wiring actuators to output modules. PLC operation and working cycle. Timer function blocks and their programming. Counter function blocks and their programming. Time diagrams. Writing programs based on time diagrams. Sequential programs and sequential bits. Writing programs based on algorithm and on state diagrams. Analog sensors and actuators. Analog input and output modules. Open systems. Programming languages according to IEC61131 standard. Specialized input and output modules. Feedback control. PID controller. Standards for communication with PLCs and networking. Human-machine interface (HMI).

Methods of teaching:30 hours of lectures, 30 hours of laboratory exercises.

Grading System: Mid-term exams 10%+10%, Lab. work 10%, Project 40%, Final exam 30%.

Literature:

1. Hugh Jack, *Automating Manufacturing Systems with PLCs*, http://hughjack.com/book_plcs/
2. W. Bolton, *Programmable Logic Controllers*, 5th Ed, Newnes, 2009
3. Graune, Thielert, Wenzl, *LOGO! Practical Training,* Publicis Publishing, 2009
4. Hans Berger, *Automating with SIMATIC*, Publicis Publishing, 2003
5. Manualet e PLC-ve LOGO! dhe S7-200 të Siemens.

Course title: Sensors and actuators (Elective, Sem V., 4 ECTS)
The goal: The goal of the course is to introduce students with different types of sensors and actuators that are used for process monitoring, instrumentation, and control, together with their signals and processing for succesfull cooperation with other parts of the system.
Learning outcomes: On successful completion of the course, students will be able to: 1. know sensors and signals at their output; 2. select proper sensors that fulfill task requests; 3. design and implement necessary circuit for adaption of signals between units; 4. make actuator selection according to requested specifications; 5. select adequate drive for actuator and to configure it; 6. develop drive circuits of basic structure and complexity; 7. program basic functionalities for interconnecting sensors and actuators for execute monitoring, acquisition, and control tasks.
Course content: Introduction to the course, control systems structure and place of sensors and actuators in them. Measurement and usage of measured values. Performance specification and time and frequency domain analysis, static and dynamic characteristics, nonlinearities. Analog signal processing, amplifiers, analog filters, and modulations. Interconnection with digital systems, sampling and holding, multiplexing, A/D and D/A converters. Digital processing, digital filters. Circuit and program based linearization. Circuit for specific alternation of signals. Display devices. Analog motion sensors. Torque, force, and tactile sensors. Temperature, pressure, and flow sensors. Digital motion sensors. Actuators and power drives, logic (On/Off) and proportional, linear, phase and pulse, with analog and digital command. Step motors and drive methods. DC motors. Induction and synchronous motors, variable frequency drives. Linear electric, hydraulic, and pneumatic actuators. Interconnection with acquisition, monitoring, and control units (microcomputer systems, computers, PLC).
Methods of teaching:30 hours of lectures, 30 hours of laboratory exercises.
Grading System: Mid-term exams 10%+10%, Lab. work 20%, Project 30%, Final exam 30%.
Literature:

1. Clarence W. de Silva, *Sensors and Actuators: Control System Instrumentation*, CRC, 2007
2. Jacob Fraden, *Handbook of Modern Sensors: Physics, Designs, and Applications*, Springer, 2010
3. Richard C. Dorf (Ed.), *The Mechatronics Handbook*, CRC, 2002
4. William C. Dunn , *Introduction to Instrumentation, Sensors, and Process Control*, Artech House, 2006

5. Lavdim Kurtaj, *Mechatronical Project*, WUS-Austria and University of Prishtina, 2011

Course title: Smart actuators and drives (Elective, Sem V., 4 ECTS)
The goal: The goal of the course is to introduce students with structure of distributed systems for monitoring, instrumentation, and control, and with smart actuators with integrated drives. Introduction with architecture, functionality of smart actuator construction blocks, and communication networks, standards, and protocols.
Learning outcomes: On successful completion of the course, students will be able to: 1. know smart actuators and ways of communication with them; 2. select proper actuator that fulfill task requests; 3. design and implement functional systems with smart actuator; 4. make smart actuator selection according to requested specifications; 5. configure smart actuators for interplay in network; 6. design and implement smart actuator (electronic part for driving and processing, programming part) with basic structure based on microcontroller.
Course content: Introduction to the course, structure of modern control systems, distributed control structure. Communication networks and communication with distant sensors and actuators. Smart actuators and structure, drive block, measurement block, digital processing block, communication block. Local block for monitoring configuring and commanding. Measurement and using measured values for advanced and sensorless drives. Static and dynamic characteristics, nonlinearities. Analog signal processing, amplifiers, analog filters, and modulations. Interconnection with digital systems. Digital processing system (with microprocessor, microcontroller, DSP, programmable digital circuits, CPLD, FPGA), digital processing, digital controllers (circuit and software based). Linear and pulse drives with microprocessor digital control. Specific functional processing, self-diagnosing, learning and adaption, coding, security, fail-safe. Communicating with human (HMI), local devices for display and for accepting commands. Standard sensor and actuator communication networks, wired (AS-i, Profibus, DeviceNet, Industrial ethernet, ModBus) and wireless (ZigBee, WiFi), protocols. Access to other maintenance functions from distance.
Methods of teaching: 30 hours of lectures, 30 hours of laboratory exercises.
Grading System: Mid-term exams 10%+10%, Lab. work 20%, Project 30%, Final exam 30%.
Literature:

1. Clarence W. de Silva, *Sensors and Actuators: Control System Instrumentation*, CRC, 2007
2. Gerard Meijer (Ed.), *Smart Sensor Systems*, Wiley, 2008
3. Victor Giurgiutiu, Sergey Edward Lyshevski, *Micromechatronics: modeling, analysis, and design with MATLAB*, CRC, 2009
4. Lavdim Kurtaj, *Mechatronical Project*, WUS-Austria and University of Prishtina, 2011
5. Nikolay V. Kirianaki, Sergey Y. Yurish, Nestor O. Shpak, Vadim P. Deynega, *Data Acquisition and Signal Processing for Smart Sensors*, Wiley, 2002

Course title: Smart sensors (Elective, Sem. V, 4 ECTS)
The goal: The goal of the course is to introduce students with structure of distributed systems for monitoring, instrumentation, and control, and with smart sensors as part of them. Introduction with architecture, functionality construction blocks and communication networks, standards and communication protocols.
Learning outcomes: On successful completion of the course, students will be able to: 1. know smart sensors and ways of communication with them; 2. select proper actuator that fulfill task requests; 3. design and implement functional systems with smart sensors; 4. make smart sensor selection according to requested specifications; 5. configure smart sensors for interplay in network; 6. design and implement smart sensor (electronic part programming part) with basic structure based on microcontroller.
Course content: Introduction to the course, structure of modern control systems, distributed control structure. Communication networks and communication with distant sensors and actuators. Smart sensors and structure, measurement block, digital processing block, communication block. Local block for monitoring and configuring. Measurement and usage of measured values. Performance specification with time and frequency domain analysis. static and dynamic characteristics, nonlinearities. Analog signal processing, amplifiers, analog filters, and modulations. Interconnection with digital systems, sampling and holding, multiplexing, A/D and D/A conversion. Digital processing system (with microprocessor, microcontroller, DSP, programmable digital circuits, CPLD, FPGA), digital processing, digital filters, linearization 9circuit and program based). Specific functional processing, self-diagnosing, learning and adaption, coding, security. Communicating with human (HMI), local devices for display and for accepting commands. Standard sensor and actuator communication networks, wired (AS-i, Profibus, DeviceNet, Industrial ethernet, ModBus) and wireless (ZigBee, WiFi), protocols. Access to other maintenance functions from distance.
Methods of teaching: 30 hours of lectures, 30 hours of laboratory exercises.
Grading System: Mid-term exams 10%+10%, Lab. work 20%, Project 30%, Final exam 30%.
Literature:

1. Clarence W. de Silva, *Sensors and Actuators: Control System Instrumentation*, CRC, 2007
2. Randy Frank, *Understanding Smart Sensors*, 2nd Edition, Artech House, 2000
3. Gerard Meijer (Ed.), *Smart Sensor Systems*, Wiley, 2008
4. Lavdim Kurtaj, *Mechatronical Project*, WUS-Austria and University of Prishtina, 2011
5. Nouredine Hadjsaïd, Jean-Claude Sabonnadière (Eds.), *Smart grids*, ISTE, 2012.

Course title: Communications in automation (Elective, Sem. V, 4 ECTS)
The goal: The objective of this course is to gain general knowledge about data telecommunication networks, knowledge about particular communication systems used in automation and their specifications, to learn systematic approach in design of complex systems.
Learning outcomes: On successful completion of the course, students will be able to:1.demonstrate knowledge and understanding of specifics of the industrial communication networks; 2. identify type of network to be used depending on nature of the problem; 3.

evaluate network properties for working in real time; 4. to design communication systems for telemetry, remote control, control of equipment with decentralized structure; 5. to develop, maintain, and use industrial networks;

Course content: Control systems with communication networks: design, telemetry, remote control, controllability and operation in real time. ISO/OSI reference model: overview of layers function, protocols, connection and connectionless services, transparency and virtual links. Physical links between distributed control building blocks: wired transmission media, fiber optics, radio links, topologies, serial/parallel transmission, simplex, half-duplex and full-duplex links, standards of physical layer (RS-232, RS-485), synchronization, channel coding (parity, CRC). Logical links; connection, connectionless and connectionless with confirmation, protocols. Fieldbuses: purposes and use, operation in real time, and synchronization, Profibus, ModBus, CAN, TTP. Wireless networks, ZigBee. Local area networks: concept of ISO standards 8802, Ethernet family (standard, fast, giga, industrial, hyperLAN). Local area building blocks.

Methods of teaching: 30 hours of lectures, 30 hours of laboratory exercises.

Grading System: Mid-term exams 10%+10%, Lab work 20%, Project 30%, Final exam 30%.

Literature:

1. Michael Duck, Richard Read, *Data Communications and Computer Networks: For Computer Scientists and Engineers*, Prentice Hall, 2003
2. Bogdan M. Wilamowski and J. David Irwin, *Industrial Communication Systems*, The Industrial Electronics Handbook, CRC, 2011
3. Steve Mackay, Edwin Wright, Deon Reynders, John Park ASD, *Practical Industrial Data Networks: Design, Installation and Troubleshooting*, Newnes, 2004
4. Deon Reynders, Steve Mackay, Edwin Wright, *Practical Industrial Data Communications: Best Practice Techniques*, Newnes, 2004
5. Marco Di Natale, *Understanding and Using the Controller Area Network Communication Protocol: Theory and Practice*, Springer, 2012

Course title: **Computer Networking** (Elective, Sem. V, 4 ECTS)

The aim of the course (module): Introduction to ISO model layers, familiarity with communication protocols, description and operation of services at the application, transport, network, and physical layers.

Learning outcomes: After completing this course (course) the student will be able: (1) gain a basic knowledge of protocol layers and services, (2) have basic knowledge of TCP / IP protocols (3) be able to apply protocols, (4) be able to make network configuration, (5) have a basic knowledge of distributed applications in networks, (6) to be able to make management networks, (7) to understand applications based on TCP / IP protocols.

Course content: layer protocols and services, Internet Service Provider (ISP), Internet History. Principles of network applications, Web, HTTP, FTP, email, DNS and web server. Introduction to the transport layer services, multiplexing and de-multiplexing, reliable data transfer, TCP Protocol, wireshark tool for monitoring traffic, routing, network service model, virtual circuits and datagram networks, ports, IP protocol, routing algorithms, routing in the internet, link layer services, error detection codes, CRC, MAC, LAN, Ethernet Hubs & Switches, PPTP protocol, CDMA, WiFi, Mobile IP, cellular architecture, small offices home office network configuration (SOHO)

Methods of teaching: 30 hours for lectures, 15 hours for numerical exercises and 15 hours for laboratory exercises. Approximately 90 hours of independent work including seminar paper.
Grading System: Attendance and classroom activity: 10%, intermediate evaluations 30%, final exam 60%
Literature:
1. James F. Kurose & Keith W. Ross, "Computer Networking", 6th Ed., Pearson Inc.., 2012
2. Douglas Comer, "Internetworking with TCP / IP, Principles, Protocols, and Architecture"

Course title: Operating Systems (Elective, Sem V. 4 ECTS).
The goal: Course aim is to train students understand basic concepts and get knowledge in modern operating systems.
Learning outcomes: On successful completion of the course, students will be able to: 1. To understand main concepts and the structure of operating system; 2. To compare and make distinction among different operating systems; 3.To manage with process conflicts and executing threads; 4. To manage with memory, processor and input/output units; 5. To analyze operating systems and implement a paperwork relating particular issues with operating systems.
Course content: Introduction to operating systems. Operating system structure, Process management: process concepts, threads, process scheduling, process synchronization, deadlocks. Memory management: memory management strategy, virtual memory management. I/O Management: file system, file system implementation, structure of disk data saving into. I/O systems, Operating System Protection. Operating System Security. Analysis and Studies on operating systems: UNIX, Linux, Windows, Minix, Mach, Android.
Methods of teaching: 30 hours of lecture, 30 hours of auditoria exercises and laboratory exercises. Approximately 100 hours of personal study and exercise including project.
Grading System: Attendance 10%, Project 30 %, written tests or final exam 60%.
Literature:
1. Abraham Silberschatz, Peter Baer Galvin dhe Greg Gagne ,"Operating System Concepts", 8th Edition, 2009.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 3rd Edition, 2008.

Course title: Entreprenuership (Elective, Sem IV, 6 ECTS)
Course/Module aim: This module aims to introduce to students the basic concpets of innovation and entreprenuership in order to stimulate their entrprenurial learning and action.
Expected outcomes : At the end of this course, the students shall be able to:
Understand the concepts of entreprenuership and inovation. Understand how these concepts differ from traditional management. Have basic understanding of mainstream theories relating to entreprenuership and innovation. Understand the requirements of starting a business. Understand basic pillars of business models. Understand various sources of business financing. Understand the usage of technology and the impact of internet on entreprenuership practice. Have basic understanding of the experience and case studies from the day to day practice of entrprenuership in Kosovo.

Course contents: Innovation practice and systemic entreprenuership. Entreprenuership in practice. Entreprenurial strategies. Business Model Framework. Business Model Patterns. Business model design techniques. Business strategy based on business model framework. Innovative business model desing processes. Examples of business models in practice and the application of the business model canvas.
Teaching methodology: 30 hours of lectures, 30 hours of practice. Approximately 100 hours of independent work, including the business plan preparation. During practice an important role is played by guest lecturers who are usually sucessfull kosovar entreprenuers or representatives of organizations that promote and support entreprenuership development.
Grading: Business Plan 40%, Final Exam 60 %
Literature :

1. Peter F. Drucker: Inovacioni dhe Ndërmarrësia, Shtëpia Botuese e Librit Universitar 2010, Tirane
2. Alexander Oswalder dhe Yves Pigneur: Business Model Generation, John Wiley and Sons, 2010.

Course title: Modeling and Simulation (Mandatory, Sem VI , 5 ECTS)
Course objectives: This course aims to: Convey the analytical and practical details of a range of modeling techniques. Familiarize with programming in Matlab and Simulink. Provide an understanding of approaches to model physical systems with typical experimental, and control systems as well.
Learning outcomes: Students should be able to do the following upon completion of this course: Express a linear system in terms of its differential equation, transfer function, magnitude response, impulse response and step response, be able to convert between the different forms and explain the advantages of each. Derive expressions that can be used to estimate parameters from different types of data, for different types of model structures. Synthesize Matlab code to simulate a given system or model. Implement a suitable model for a given problem, making informed choices about the model type and model order, and calculate the model error.
Course content: The basic principles of dynamic system modeling. Transition from one model to another model, model linearization. Dynamic system simulation, introduction to Matlab and Simulink. Mechanical system modeling. Electrical system modeling, circuits and electromagnetic systems. Hydraulic process modeling. Thermal processes. Simulation and design of control systems.
Teaching methodology: 30 hours of lectures+15 hours of tutorial+15 hours of laboratory. Approximately 75 hours of personal study, including homework exercises.
Grading System: Homework 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. "Simulation of Dynamic Systems with MATLAB and Simulink", Klee, H., CRC Press, Boca Raton, FL., 2007.
2. "Modeling and simulation of dynamic systems", Woods, R. L., and Lawrence, K. L., ,Prentice-Hall, Upper Saddle River, NJ, 1997.

Course title: Fundamentals of robotics (Mandatory, Sem. VI, 5 ECTS)
The goal: Familiarity with robotic concepts, Describing relative positions and motions in space. Methods for calculating dynamic interactions. How to do joint control and reactions between then. Failiarity with mathods for task decomposition at different execution levels. Familiarity with sensors and processing of their information. Robot programming.
Learning outcomes: On successful completion of the course, students will be able to: 1. identify robot structure and characteristic elements; 2. describe motions and to calculate dynamic interactions; 3. design robot joint controller; 4. make transition from given problem to necessary executive details; 5. get engaged into advanced control and information processing from different sensors, as foundation for making "intelligent" robots.
Course content: Introduction and historic development of robotics. Direct kinematics problem. Rotation and composite matrix. Image geometry. inverse kinematics problem and methods, analytic, geometric, and numeric. Robot arm dynamics. Lagrange-Euler formulation. Newton-Euler formulation. Manipulator trajectory planning. Interpolated trajectories at different levels. Planning trajectories in Cartesian space. Planning trajectories under different constraints. Controlling robotic manipulator. Controlling PUMA and CRS Catalyst-5 robot. Computed torque technique. Other control methods. Adaptive control. Sensors in robotics. Visual information processing. Robot programming.
Methods of teaching: 30 hours of lectures, 15 hours of auditory exercises, 15 hours of laboratory exercises.
Grading System: Mid-term exams 10%+10%, Lab. work 20%, Final exam 30%+20%.
Literature:

1. K.S. Fu, R.C. Gonzales, C.S.G. Lee, *ROBOTICS, Control, Sensing,Vision, and Intelligence*, McGraw-Hill
2. Paul P., *Robot Manipulators Mathematics, Progrmming and Control*, MIT Press
3. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, *Robotics - Modelling, Planning and Control*, Springer, 2009
4. Antti J. Koivo, Fundamentals for Control of Robotic Manipulators, John Wiley & Sons, 1989

Course title: Nonlinear Control Systems (Elective, Sem. VI, 4 ECTS)
The goal : The purpose of this course is to introduce the students with the nonlinear counter part of control systems. The discussions will focus on the influence of typical nonlinear components and other form on nonlinearity on the response of control systems. Different forms of analyzing nonlinear systems will be introduced.
Learning outcomes: On successful completion of the course, students will be able to: 1. Tell the difference between linear systems (modeled in the working point) and systems with nonlinearities in them. **2.** Observe the distortions that nonlinear components introduce in control systems and the influence of these distortions in the performance of control systems 3. Apply the phase plane method and the isoclines method to analyze system features. 4. Understand special effects that are only found in nonlinear systems (such as limit cycles) 5. Fully understand the concept of describing function and its importance in the study of nonlinear control systems.
Course content: Introduction to the typical forms on nonlinear components. The difference between the mathematical apparatus used in the linear and nonlinear control systems. The

influence of nonlinear components and other forms on ninlineary in the study of control systems. Methods of analyzing nonlinear systems. Limit cycles and their properties. Types of singular point and their analysis. Nonlinear system analysis in the phase plane and their phase trajectories. Phase trajectories for typical nonlinear components. Nonlinear system analysis using the isoclines method. The describing function: nonlinear system study using the describing function. Deriving describing functions for typical nonlinear elements.

Methods of teaching: 30 hours of lectures + 15 hours of auditorial exercises + 15 hours of laboratory exercises. Approximately 100 hours of personal study and exercise including seminars.

Grading System: Seminar 10%, Mid-term exams 30 %, Final Exam 60 %

Literature:

1. J. J. Slotine & W. Li, *Applied Nonlinear Control*, MIT Press
2. H. K. Khalil, *Nonlinear Systems*
3. A. Skeja, *Sistemet Jolineare,* Authorized Lecture Notes

Course title: Chemical Process Control (Elective, Sem. VI., 4 ECTS)

Course objectives: This course aims to provide an introduction to control of chemical engineering processes.

Learning outcomes: Upon the completion of the course students will be able to model and implement control solutions for common chemical processes that arise in practice, such as reactor with mass transfer, distillation column; pH systems, etc.

Course content: Mathematical models of chemical engineering systems. Examples of mathematical models of chemical engineering systems: Series of isothermal, constant and variable holdup CSTRs; two heated tanks; reactor with mass transfer; ideal binary distillation column; pH systems. Computer simulation: numerical methods. Examples: gravity-flow tank, non-isothermal CSTR, multi-component distillation column, batch reactor. Time-domain dynamics and control. Frequency-domain dynamics and control. Multivariable process control.

Teaching methodology: 30 hours of lectures+30 hours of supervised exercises. Approximately 75 hours of personal study, including homework exercises.

Grading System: Homework 10%, Mid-term exams 30 %, Final Exam 60 %

Literature:

1. Luyben, W., "*Process Modeling, Simulation, and Control for Chemical Engineers*", McGraw-Hill, 1996
2. Stephanopoulos G., "*Chemical Process Control, an Introduction to theory and practice*", Prentice-Hall, 1984.
3. Coughanowr, D., "*Process system analysis and control*", McGraw–Hill, 2008.

Course title: Continuous and Batch Processes (Elective, Sem VI, 6 ECTS)

Course objectives: The course teaches students the characteristics of continuous and batch processes as well as the requirements for control strategies and instrumentation associated with these types of processes.

Learning outcomes: After the course, the students will understand the fundamental differences between batch and continuous operation. They will be able to apply state-of-the-art monitoring, control and optimization techniques in industrial processes.
Course content: Characteristics of continuous and batch processes: Introduction to continuous and batch processes, fundamental and other important variables. Control of processes: final control element, control algorithms. Signal transmission and instrumentations. Control strategies for continuous and batch processes: feedback control, cascade control, feed-forward control.
Teaching methodology: 30 hours of lectures+30 hours of supervised exercises. Approximately 75 hours of personal study, including homework exercises.
Grading System: Homework 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. Carlos A. Smith, Armando B. Corripio; "*Principles and Practices of Automatic Process Control*". John Wiley & Sons, 2005.
2. Dale E. Seborg, Duncan A. Mellichamp, et al.; "*Process Dynamics and Control*", Wiley, 2010.
3. Terrence Blevins, and Mark Nixon; "*Control Loop Foundation-Batch and Continuous Processes*", International Society of Automation, 2010.

Course title: Real-time control systems (Elective, Sem. VI, 4 ECTS)
The goal: The aim of the course is that the student should learn how to design and implement computer-based control systems that meets task real-time requirements.
Learning outcomes: On successful completion of the course, students will be able to: 1. implement a computer-based control systems using concurrent programming techniques; 2. apply basic scheduling analysis for real-time systems; 3. use state machines for implementation of event-based control systems; 4. design multitask programs where communication and synchronization is realized using semaphores, monitors, and messages; 5. design and program a computer-based control system on PID form and state-space form; 6. understand how time-delays and jitter affect control performance; 7. understand the problems associated with control over networks.
Course content: Introduction to Real-Time Systems. Definitions of Real-time systems. Embedded systems. Designing and Developing Real-time Systems. Architecture. Interrupts and Exceptions. Timers and Real-time Facilities. Real-Time Devices. Event driven activities, state machines. I/O Devices and Buses: Serial devices and parallel devices, Peripheral serial buses. Multitasking in Real-Time Systems: Scheduling, Synchronization, Inter-task communication. Real-time kernels and operating systems. Data Acquisition and Control Systems: Analog to digital conversion and digital to analog conversion, multi-threaded real-time data acquisition, applications using real-time data acquisition and control. Periodic and event-based control tasks. Integrated Control and Scheduling. Implementation aspects. Control over networks.
Grading System: Mid-term exams 10%+10%, Lab work 20%, Project 30%, Final exam 30%.
Literature:

1. Jane W. S. Liu, *Real-Time Systems*, Prentice-Hall, 2000
2. Insup Lee , Joseph Y-T. Leung , Sang H. Son, *Handbook of Real-Time and Embedded Systems*, CRC, 2007

3. Kim R. Fowler, *What Every Engineer Should Know About Developing Real-Time Embedded Products*, CRC, 2008
4. Rob Williams, *Real-Time Systems Developmen*, Butterworth-Heinemann, 2005

Course title: Computer data acquisition and analysis (Elective, Sem. VI, 4 ECTS)
The goal: The goal of the course is to provide an introduce to computer systems for data acquisition from different sources by type, speed, amount and space distribution, storing collected data, analysing and presenting results of anaysis.
Learning outcomes: On successful completion of the course, students will be able to: 1. estimate type of data and to select adequate acquisition system; 2. design and implement local system for data acquisition; 3. use different mechanisms for transporting data to distance, with wires ore wireless; 4. understand and use systems for storing massive amount of data; 5. develop applications for data processing; 6. design and program systems for presenting results in as much as possible human friendly form.
Course content: Introduction to structure of data acquisition systems. Concentrated local systems. Input units for different types of data sources: discrete and analog, slow and fast, periodical and transitory, with small and large amount of data. Storing media, volume, access time, and security. Processing software with general dedication (MATLAB and LabVIEW). Development user dedicated applications (C, C++, VB, assembler and specialized software). Distributed sistems and communication infrastructure. Clock synchronization (time). Communication over wired networks (RS-232, RS-485, CAN, Ethernet). Communication over power lines and optical fibers. Wireless communication and exploitation of existent communication networks (radio links, ZigBee, WiFi, GPS, GPRS). Communication protocols (IEC, DNP, ModBus) and protocol converters for communication over heterogeneous networks. Remote terminal units. Systems for supervisory control and data acquisition. Units for presenting data and analysis results as well as communicating with human.
Methods of teaching: 30 hours of lectures, 30 hours of laboratory exercises.
Grading System: Mid-term exams 10%+10%, Lab. work 20%, Project 30%, Final exam 30%.
Literature:
1. John Park, Steve Mackay, *Practical Data Acquisition for Instrumentation and Control Systems*, Newnes, 2003
2. David Bailey, Edwin Wright, *Practical SCADA for Industry*, Newnes, 2003
3. Viktor Boed, *Networking and Integration of Facilities Automation Systems*, CRC Press, 1999
4. Gordon Clarke, Deon Reynders, *Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems*, Newnes, 2004
5. Michele Vadursi (Ed.), *Data Acquisition*, Sciyo, 2010

Course title: Building automation (Elective, Sem VI., 4 ECTS)
The goal: The goal of the course is to introduce systems for home, building, and other objects were people live and work, as road toward socalled smard buildngs. Introduction to topology,

communication infrastructure, and constituent elements. Fullfillment of requests for configuration, programming, and documenting the system.
Learning outcomes: On successful completion of the course, students will be able to: 1. know functional details of building automation; 2. know topologies of building automation systems and their potential;3. design automation system according to given specifications; 4. according to gained knowledge to select proper sensors and actuators; 5. understand and implement selected communication structure; 6. configure and program systems constituents so they can operate as a whole; 7. document and understand documentation of automation systems.
Course content: Common electrical installation. System structure in home and buildings. Topologies, potential and importance of automation. Intelligent buildings. Comfort, security, and energy savings. Historical development and integrated communication infrastructure. Direct digital control. Residential building automation as distributed control system. Collecting information from sensors. Recording, monitoring, and alarming. Actuators and interconnection with communication infrastructure. Functional interconnection of sensors and actuators over communication network. Control centers and accessing from distance. Ways of communication: dedicated wires, over power lines, wireless, optical fibers. Open and proprietary communication standards (X10, BACnet, LonTalk, KNX/EIB, ZigBee). Configuring and programming. Programming languages: ladder diagram, functional blocks, instruction list, structured text, and structured functional diagrams. Designing and documenting. Integration with future smart networks.
Methods of teaching:30 hours of lectures, 30 hours of laboratory exercises.
Grading System: Mid-term exams 10%+10%, Lab. work 20%, Project 30%, Final exam 30%.
Literature:

1. Shengwei Wang, *Intelligent Buildings and Building Automation*, Spon Press, 2010
2. Hermann Merz, Thomas Hansemann, Christof Hübner, *Building Automation: Communication systems with EIB/KNX, LON und BACnet*, Springer, 2009
3. Viktor Boed, *Networking and Integration of Facilities Automation Systems*, CRC Press, 1999
4. Robert McDowall, *Fundamentals of HVAC Control Systems*, Butterworth-Heinemann, 2006

Course title: Internship (Mandatory, Semester VI, 6 ECTS)
The goal: The students gain professional experience, depending on the field of study, in one of the local companies.
Learning outcomes: To be qualified for professional work, in the relevant field of study, and to be more prepared for the labor market.
Course Content: The content of this course depends on the company where the student shall finish 120 working hours. As a result, the content is drafted jointly from the coordinator of professional internships, appointed from the company, and the student who is going to work in such company. The coordinator of professional internships, who is appointed from the company, guides the student throughout the duration of his/her work in the company, and participates as a member of the commission in the presentation of the professional paper.
Teaching methodology: 120 working hours in the company, 30 working hours for the preparation of the presentation of professional internship.

Assesment: Presentation evaluation 40%, Presentation of the paper: 60%. Total:100%

Course title: Bachelor thesis (Mandatory, Sem VI. 6 ECTS)

The goals : The bachelor thesis is a comprehensive and independent task where the student has to demonstrate the ability to analyze the given problem from theoretical and practical aspects, devise a solution using the knowledge acquired in multiple courses and literature.

Learning outcomes: Upon completionofthis module studentswillbe able to:1. Togainconfidenceingained knowledge2.Have theability tofurther studiesofmandatory oradditional literature3.Consult withmentorwithquestionswellpreparedand structured; 4. Presenttheir workinwritten form, withastandard languageand guidelinesforthistypeof work, witha volume ofat least30sheetsofA4 format5.Topresentthe workin time of tenminutes with presentation prepared in PowerPoint

Course content: The thesis could be proposed by the supervisor or can be chosen by the student, and should be in the accordance with the qualification profile. The bachelor thesis is a comprehensive and independent task where the student has to demonstrate the ability to analyze the given problem from theoretical and practical aspects, devise a solution using the knowledge acquired in multiple courses and literature, and provides instructions for use and directions of future development.

Methods of teaching:

Compliant with the actual regulation at the faculty level on how to conduct a bachelor thesis.

Literature:

1. Depending on the bachelor thesis, will be offered different literature from mentor.