Program Overview – Power Engineering

Year I							
Semester I			Hours/Week				
Nr.	M/E	Courses	L	NE	Lab	ECTS	Teacher
1.	M	Analysis of Electric Circuits	2	2	0	6	
2.	M	Electromagnetic Fields	2	2	0	6	
3.	M	Mathematics Methods in Engineering	2	2	0	6	
4.	M	Power System Analysis	2	2	0	6	
5.	M	Dynamics of Electrical Machines	2	2	0	6	
Semester II							
1.	M	High Voltage Technology and System Engineering	2	2	0	6	
2.	M	Planning and Operation of Power System	2	2	0	6	
3.	M	Power System Control and Stability	2	2	0	6	
	E	Elective courses: **Electric Power Systems** 1. Power System Dynamics 2. Overhead and Cable Lines 3. Advanced Technology and Renewable Resources 4. Power System Measurements 5. Methodology of Scientific Research	 2 2 2 2 2	 2 2 2 2 2	 0 0 0 0 0	 6 6 6 6 6	
	E	Elective courses: **Renewable Resources, Energy Efficiency and Energy Economics** 1. Advanced Power Electronics 2. Introduction to Theory of Energy Markets 3. Energy Management 4. Wind Energy Conversion 5. Methodology of Scientific Research	 2 2 2 2 2	 2 2 2 2 2	 0 0 0 0 0	 6 6 6 6 6	
	E	Elective courses: **Electrical Drives and Machines** 1. Advanced Power Electronics	 2	 2	 0	 6	

Nr.	M/E	Courses	L	NE	Lab	ECTS	Teacher
		2. Special Chapters of Electrical Machines 3. Control of Electrical Drives 4. Methodology of Scientific Research	2 2 2	2 2 2	0 0 0	6 6 6	
Year II							
Semester III			Hours/Week				
Nr.	M/E	Courses	L	NE	Lab	ECTS	Teacher
1.	M	Protection and Security of Power System	2	2	0	6	
2.	M	Energy Economics	2	2	0	6	
	E	Elective courses: **Electric Power Systems** 1. Distribution Networks and Distribution Generation 2. Power System Supervision and Remote Control 3. Design and Construction of Power Systems 4. Power Quality 5. Smart Grid	2 2 2 2 2	1 1 1 1 1	1 1 1 1 1	6 6 6 6 6	
	E	Elective courses: **Renewable Resources, Energy Efficiency and Energy Economics** 1. Energy and Environment 2. Energy Management and Energy Efficiency 3. Solar Photovoltaic Energy Conversion 4. Energy Management 5. Smart Grid	2 2 2 2 2	1 1 1 1 1	1 1 1 1 1	6 6 6 6 6	
	E	Elective courses: **Electrical Drives and Machines** 1. Small Engines 2. Modeling and Simulation of Electrical Drives 3. CAD in Electrical Machines 4. Wind Energy Conversion 5. Transient Regime in Electrical Drives	2 2 2 2 2	1 1 1 1 1	1 1 1 1 1	6 6 6 6 6	
Semester IV							
1.	M	Master Thesis				30	

Course title**: Analysis of Electric Circuits** (Mandatory, Sem.I, 6ECTS)
The goal: The purpose ofthe course is tointroducethe most advanced methodsof analysis ofelectrical circuits.
Learningoutcomes**:** After completion of the course, students will be able to:
1. Knowthe basic conceptsofgraphtheory, to analyze circuitswith computer programs. 2. Analyze circuits in complex frequency domain (Laplace). 3. Recognize and identify networks with two inputs that find wide use in all areas of electrotechnics especially in electronics, telecommunications and automatics. 4. To know the characteristics of the lines a selectrical circuits with distributed parameters, electromagnetic processes which occur in lines, thephonelines, lines for high frequency broadcasting.
Course content**:** Basics of topology of electrical circuits. Basic concepts in the theory of graphs. Topological matrices of graphs. Equations of networks. Laplace Transform. Two input networks. z Parameters. y Parameters. Hybridparametersh. Transmissionparameters. Connecting two input networks. Electric linesasdistributedparameter circuits. The phenomenon of line reflections.
Methods of teaching**:** 30 hours of lectures + 30 hours of numerical exercises.
Grading System: Mid-term exams 20% +20% intermediate, FinalExam 60%
Literature**:**

1. M. Bogdanov, B. Kastrati, "Teoria e qarqeve elektrike", Prishtinë, 1985
1. Ch. Alexander, M. Sadiku, "Electric Circuits", New York, 2003
2. Raymond A.DeCarlo, Pen-Min Lin, "Linear Circuit Analysis", Prentice-Hall, 1995
3. Robert L. Boylestad, "Introductory Circuit Analysis", Prentice-Hall, 2000
4. James W. Nilsson, Susan A. Riedel, "Electric Circuits", Prentice-Hall, 2001

Course title: Electromagnetic Fields (Mandatory, Sem I, 6 ECTS)
The goal: To provide students with the advanced level of comprehending on the theory of classic electromagnetic field, enabling them to master key analytical tools for solving real power engineering problems.
Learning outcomes: On successful completion of the course, students will be able to: 1. Demonstrate knowledge of the theory of electromagnetic field and Maxwell's equations; 2. Present analytical methods for solving both field theory and practical problems; 3. Discuss various applications of electromagnetic theory ; 4.Select adequate models and solution methods for specific power engineering problems; 5. Prepare and present a seminar on application of electromagnetic fields on solving power engineering topic
Course content: Vector Analysis: Gradient, Divergence and Curl, Laplacian operator. Electrostatics: Coulomb's law. Electric lines of force. Evaluation of electric field and potential in vacuum and in the presence of conducting and dielectric materials. Practical electrostatic problems. Energy and forces in electrostatic systems. Boundary-value problems. Method of images.Direct current: Ohms and Joules laws. The continuity equation. Boundary-value problems. Static magnetic fields: Biot-Savarts and Ampére laws. Fields in magnetic materials. Magnetic curcuits. Electromagnetic induction:Faradays law. Mutual and self-induction. Transformation of electrical and magnetic fields between systems with uniform velocity. Energy and forces in static and quasi-stationary fields..Basics of electromagnetic waves and transmission lines.
Methods of teaching:30 hours of lectures + 30 hours of combined exercises. Approximately 80-90 hours of personal study and exercise including assignments.
Grading System: Seminar 30%, Mid-term exam 30 %, Final Exam 40 %
Literature:

1. Nathan Ida, Joao P.A. Bastos "Electromagnetics and Calculation of Fields" Springer-Verlag New York, LLC, 2012
2. Alajdin Abazi, Luan Ahma "Teoria e fushes elektromagnetike", 2000
3. Few research paper on electromagnetic application on power engineering

Course title: Mathematics Methods in Engineering (Mandatory, Sem. I, 6 ECTS)
The goal: The purpose of thecourse is toenablestudentsthatknowledge gainthroughthis coursecan applyasanauxiliarydeviceintheprofessional coursesofelectrical engineeringandcomputer study.
Learning outcomes: On successful completion of the course, students will be able to:
After the course, each student is expected to be prepared for the present situation and the future by the modern approach to areas listed above. In this course three phases of solving problems are given: Modeling, Solving and Interpreting of all topics that are in this course which are going to help students to get prepared to apply this knowledge in their further studies, like -Solving different kind of problems from differential equations and applying them to practical fields -Solving problems from linear algebra, theory of graphs and Boolean algebra and applying them to practical problems.
Course content. First-order differential, Second-order linear differential, Higher order linear differential, Systems of differential equations, Phase plane, stability, Laplace transforms, Graphs and combinatorial optimization, Boolean algebra
Methods of teaching: 30 hours of lectures + 30 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. Ervin Kreyszig.-Advanced Engineering Mathematics, 1993
2. Kenneth H. Rosen.-Mathematics and its applications, Mc GrawHill
3. Wilfred Kaplan.-Advanced Calculus, Addison-Wesley Higher Mathematics

Course title: Power system analysis (Mandatory, Sem. II, 6 ECTS)
The goals: The purpose of the course is to gain knowledge of power system modeling and analysis.
Learning outcomes: On successful completion of the course, students will be able to: 1. Describe the procedure of determining the state vector of electrical power system. 2. Explain mathematical procedures of power flow and short circuit calculation. 3. Calculate the state vector of electrical power system.
4. Analyze electrical circumstances in the electric power system 5. Plan the power system operation.
6. Estimate the power system security
Course content: Introduction to Power Systems Analysis. Network Equations. Network models: generators, lines and transformers, voltage control devices. Admittance and impedance matrices. Numerical methods for load flow. Gauss and Gauss-Seidel methods. Newton-Raphson and F ast Decoupled Load F low. Sparse matrix algebra in network calculations. Simplified load flow models. DC models. 3-phase load flow. Fault analysis.
Methods of teaching: 30 hours of lectures + 30 hours of auditoria exercises. Approximately 100 hours of personal study and home exercises.
Grading System: First exams 15%, Second exams 15 %, Home exercises (design) 15%, Regular continuation 5%. Final Exam 50 %
Literature:

1. Hadi Saadat, Power sistem analysis, third edition, 2011,
2. Joseph J. Grainger, William D. Stevenson (1994). Power System Analysis, McGraw- Hill Education,
3. N. Selimi,L. Ahma "Analiza e sistemeve elektroenergjetike", Prishtinë 1992.

Course title: Dynamics of Electrical Machines (Mandatory, Sem I. 6 ECTS)
The goal: The aim of this course is to provide basic knowledge for transient processes in the transformer and electric machines and their dynamic mathematical modeling.
Learning outcomes: After completion of this course the student will have the basic knowledge for 1. Transient electromagnetic processes in transformator and electric machines, 2. The general theory for electrical machines, 3. Solve the mathematic model of electrical machines by appropriate computer software
Course content: Basic laws in electromechanical energy conversion. Energy balance in electric machines. Transient processes in transformer and electrical machines. Definition of general model electrical machines. General two axes theory of electrical machines. Matrix of inductivities, linear transformations in electrical machines. Geometric interpretation of the transformations. Implementation of the general model for the analysis of transient processes in electrical machines. Transitional processes in synchronous machines. Transitional processes in asynchronous machines. Transient processes in the direct current machines. Examples of calculating the transient processes by computers.
Methods of teaching: 30 hours of lectures + 30 hours of numerical exercises . Approximately 100 hours of personal study and exercise including four seminars.
Grading System: Seminar 30%, Mid-term exams 20 %, Final Exam 50 %
Literature:

1. Nysret Avdiu, Dinamika e Makinave Elektrike ligjerata të autorizuara, Prishtine 2013
2.Dynamic Simulation of Electric Machinery: Using MATLAB/Simulink, by Chee-Mun Ong Prentice Hall 1997
3. M. Jadrić, B. Frančić: Dinamika električnih strojeva, Graphis, Zagreb 1997
4. P. Vas: Electrical Machines and Drives - A space-vector theory approach, Clarendon Press-Oxford, 1996

Course title: High voltage technology and system engineering (Mandatory, Sem.II, 6 ECTS)
Objectives of the course (module): Students to gain knowledge of: measuring equipment in the lab of High Voltage Technique HVT, over voltage internal, external and coordinating protection and isolation of equipment and switchgear installations.
Learning outcomes: After completing this course (course) the student will be able to: 1. To enrich knowledge of laboratory equipment TTL metering. 2. To enrich knowledge of wave processes caused by the external appearance over voltage, interior, 3. To be able to do dimensioning and protection of equipment from transitional processes caused by over voltage and 4. Coordinate the isolation that represents a compromise between the level of insulation, protective equipment and over voltage.
Methodology of teaching: (30 hours of lectures, 20 hours of laboratory exercises and laboratory exercises 10 hours. Approximately 100 hours of independent work including processing of elaborations and project tasks.
Evaluation: Evaluation of the first 15%, second 15% rating, the third rating 15%, 5% Regular attendance, final exam 50%.
Literature: 1. I. Krasniqi, G. Latif: "Teknika e tensioneve te larta" Pristine, 1997
2. K. Denno: "High Voltage in Power SISTEMS", N. Jersey, 2010,
3. P.Vasili, N.Hobdari: " Teknika e tensioneve te larta " Tirana, 1995. M. A. Athony: Electric
4. Power System and Coordination "McGraw-Hill, Inc., NY, 2009.

Course title: Planning and Operation of Power System (Mandatory, Sem. II, 6 ECTS)
The goal: The purpose of the course is to study the principles of Power System Planning.
Learning outcomes: On successful completion of the course, students will be able to:
1. Understand the basic Principles of Power System Planning. 2. To doforecasting of growth of demand for electrical energy. 3. Learn the basic concepts of probability, stochastic processes and reliability. Calculate the reliability of Power System. 3**.** Plan new generation plant, 4. To do distribution and transmission network planning.
Course content: Power System Planning- basic principles. Load forecasting in Power System. The basic concepts of probability, stochastic processes and reliability. Power System reliability calculation. Distribution network planning. Transmission network planning.
Methods of teaching: 30 hours of lectures + 30 hours of auditorial exercises. Approximately 60 hours of personal study and exercise including seminars.
Grading System:
Seminar 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. G. Latifi, Besueshmeria e SEE, Dispence, Prishtine 1997
2. X.Wang, J.R. McDonald, “Modern Power System Planning”, McGrow-Hill, 1994
3. R. L. Sullivan, “Power System Planning”, McGrow-Hill, 1977
4. H. Seifi, Mohammad Sepasian, “Electric Power System Planning”, Springer-Verlag Berlin Heidelberg, 2011
5. Ivan A. Skokljev, “Planiranje Elektroenergetskih Sistema”, Beograd, 2000

Course title: Power System Control and Stability (Mandatory, sem.II, 6 ECTS)
Course objective: The objective purpose of the course is the introduction of the basic principles of electric power system control with the objective of its functional optimization
Expected results: Upon successful completion of the course, students are expected to be able:
1. to be familiar with basic concepts of control of electric power systems 2. to know and be able to identify main segments and concepts of electric power system control and regulation and some of its key features 3. to know electric power consumption forecast and balance as a basis for electric power system planning, operation, control and optimization 4. to know main aspects of frequency and voltage control, power dispatching and its practical application in electric power systems
Course Content: General concepts of electric power system control. Importance and key features of electric power system control. Planning and practical application of power system regulation and control. Forecast of electric power system demand. Losses of electric power and energy in power systems and possibilities for their reduction. Operational planning and optimization of power system operation. Control and regulation of frequency and active power. Operational process of frequency control. Principles of power system voltage control and regulation of reactive power. Principle of power dispatch and operational optimization of electric power systems.
Course Methodology : 30 hours of lectures and 30 hours of numerical exercises. Seminar paper. Individual and group consultations.
Evaluation: Intermediate evaluation through class activity, seminar paper and final examination.
Literature:

1. G.Pula, Elektroenergjetika, Enti per Botimin e Teksteve, Prishtine, 1984
2. A.Wood, Power Generation, Operation and Control, Wiley, New York, NY, 1996

Elective courses: Electric Power Systems

Course title: Power system dynamics (Elective, Sem II, 6 ECTS)
The goal : The aim of the course is that students acquire basic knowledge about the dynamic processes in the energy power system. Modeling of system elements with the aim of analyzing the dynamic processes in the system.
Learning outcomes: After completing this course the student will be able to:
1. Understand the mathematical model and solution methods of dynamic processes in the power system.
2. Have knowledge about mathematical modeling of the system elements
3. Analyze transient electromagnetic and electrodynamics processes in synchronous generator during faults in the system.
4. Be able to model power system using applications software and programming

Course Content: Electromagnetic transients. Three phase short circuit in synchronous generator. The main parameters of the synchronous generator. Effects of magnetic flux changing. Short circuit current in the generator. The influence of the inertia moment in the subtransient process. The impact of the amortization winding in subtransient component. Analysis of various short circuits to network and disconnection time o. Electromagnetic transient processes. Three-phase short circuit in synchronous generator. Power amortization during large speed deviations. Electro-dynamic processes - minor faults. Fault clearing without changing the equivalent network impedances.
The stability of the system in study state mode. The elimination of short circuits with / without automatic reconnection. Asymmetric faults. The impact of pre breaking load. Power fluctuations. Impact of the flux decrement. The impact of the automatic voltage regulator. Fluctuations in the multi machine system. The direct method of the stability assessment. Surface criteria for the transient stability analysis. Synchronization. Asynchronous work in the system. The impact of the voltage regulator.
Methodology of teaching: 30 hours of lectures, 25 hours numerical exercises. Approximately 100 hours of independent work including thesis seminar.
Grading : Seminar 10%, intermediate estimates 30%, final exam 60%.
Literature:
1. Power System Dynamics Stability And Control.Control. Jan Machowski, Janusz W. Bialek, James R. Bumby
2. Power System Control and Stability. P. M. Anderson, A. A. Fouad
3. Transients in Power Systems. Lou van der Sluis

Course title: Overhead and cables lines (Elective Sem. II, 6 ECTS)
The goals: The purpose of the course is to gain knowledge of electric power networks elements and gain experience with calculations of mechanical and electrical parameters of lines and cables.
Learning outcomes: On successful completion of the course, students will be able to: 1. Define the main principles of electric power transmission. 2. Explain the characteristics of power transmission by overhead lines and power cables. 3. Calculate electric parameters of overhead lines and electric cables. 4. Analysis electromagnetic fields in overhead line and electric cables and their environment. 5. Plan the construction of new overhead transmission lines and power cable lines 6. Compare the advantages and disadvantages of electric power transmission by overhead lines and electric cables.
Course content: Technical standards of overhead lines. New concepts in mechanical design of overhead lines. Compact overhead lines. The impact of power lines to communication networks. Effects of without interweaved lines on current and voltage unbalance in power grids. Materials for conductors and insulation of cables. Power cables shield. Power cables for special applications. Parameters of power

cables. Electric fields in power cables. Cable dimension. Cable networks. Interference of power cables with control and telecommunication cables.
Methods of teaching: 30 hours of lectures + 30 hours of auditoria exercises. Approximately 100 hours of personal study and home exercises.
Grading System: First exams 15%, Second exams 15 %, Home exercises (design) 15%, Regular continuation 5%. Final Exam 50 %
Literature:

1. 1.Lothar Heinhold, Power cable and there application, Part 1, John Wiley and Sons, 1996
2. 2.Lothar Heinhold, Power cable and there application, Part 2, John Wiley and Sons, 1996,
3. Thomas Shoemaker, James Mack, Lineman and Cablemans Field Manual, McGraw-Hill, 2009

Course title: Advanced technology and Renewable Resources (Elective, Sem. II, 6 ECTS)
The goals: The purpose of the course is to gain knowledge of possibilies and limitations of renewable energy sources that have a special significance in the present day. They will gain ability of performing simple calculations and estimations of advanced developing technology potentials.
Learning outcomes: On successful completion of the course, students will be able to: 1. Analyze the resources for all covered sources of energy, explain the basic differences and limitations of treated source of energy in terms of density, predictability, variability and impacts on the environment and economy; 2. Create an assessment of power and produced electricity for all energy sources covered; 3. Demonstrate the skill of using special software tools for modeling of treated energy; 4. Argue the assessment of potentials and limitations of new sources of energy compared to conventional sources.
Course content: Sunny radiation. Measuring of sunny radiation. The geometry of the Earth and the sun. Horizontal and oblique radiation. Calculation of solar forecasting. Heat solar collectors. Photovoltaic cells. Photon absorption and the efficiency of solar cells. Using solar energy to generate electricity and thermal energy. Wind energy and wind characteristics. Wind generators and efficiency. The current situation of the implementation of wind turbines to produce electricity. The use of geothermal energy. Biomass energy for heat, electricity and biofuels. Energy storage. Advanced batteries. Fuel cells. Integrating renewable sources into the power system.
Methods of teaching: 30 hours of lectures + 30 hours of auditoria exercises. Approximately 90 hours of personal study and home exercises.
Grading System: First exams 15%, Second exams 15 %, Home exercises (design) 15%, Regular continuation 5%. Final Exam 50 %
Literature:

1. J. Twidel, Tony Weir, Renewable energy resources, Taylor & Francis, London New York, 2006;
2. Kaltschmitt, W. Streicher , A. WieseRenewable Energy: Technology, Economics and Environment (Hardcover), Springer, 2007 Berlin Heldinberg, New York

1. R. Messenger, J. Ventre, Photovoltaic Systems Engineering, Second Edition, CRC Press LLC, 2004;
2. James F., Manwell, John G. Mc Gowan, Anthony L. Rogers, Wind Energy Explained, John Wiley & Sons, England, 2002.

Course name: Power System Measurements Elective, Sem II, 6 ECTS)
Course objectives: To achieve the basic theoretical and practical knowledge's about Measurements in Power systems.
Learning Outcomes: After completion of this course, student should be able to use instruments and measuring methods for measuring in power systems. Student 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 electrical installations, switchgear, electrical machines and research with special measurements.
Course Content: Measuring in electrical installations, as measuring of: *insulation resistance*, *earth and grounding resistance*. Measuring of: *voltage, current, frequency, power and electrical energy*. Measurements in *power system switchgear* and *machines*: the use of instrument transformers to measure: *voltage, current, power and electrical energy*. Discus and use methods for testing of electrical machines (transformers, generators and motors).
Teaching methodology: 30 hours lectures, and 30 hours with solution of problems. Approximately 60 hours with lecturer and teaching assistant.
Assessments: 3 tests each one 20 %, and final exam 40 %.
Bibliography:

1. A. Gashi, Matjet elektrike, ligjëratat dhe prezantimet 2012.
2. K. Iwansson, G. Sinapius, W. Hoornaert," Measuring current, voltage and power", Elsevier 1999
3. "Electrical Measurement Signal Processing and Displays**",** New York, 2002

Course title: Methodology of scientific research (Elective, Sem II., 6 ECTS)
Course objectives: To introduce some key elements of research methodology to first time research students.
Learning outcomes: At the end of this course, the students should be able to: understand some basic concepts of research and its methodologies, identify appropriate research topics, select and define appropriate research problem and parameters, prepare a project proposal (to undertake a project), organize and conduct research (advanced project) in a more appropriate manner, write a research report and thesis, write a research proposal (grants).
Course content: Overview of experimental and engineering methodological approaches to research; Basics of research design (e.g., hypothesis formulation); The research process: documenting research, sources of information, research funding, creativity and intellectual discovery; Guidelines and a framework for efficient development of research; legal and ethical issues; protecting and exploiting research; Intellectual Property rights; Managing the research project: supervision, planning and organization; problems and pitfalls; Presentation skills (written, oral); Use of relevant research tools (technology, experimental infrastructure, mathematical methods, etc.).
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. Kothari B.L., "*Research Methodology: Tools and Techniques*", New Age International Publishers, 2009.
2. Boot C. W., "*The Craft of Research*", University Of Chicago Press, 2008.

Elective courses: Renewable Resources,Energy Efficiency and Energy Economics

Course title: Advanced Power Electronics (Elective, sem.II. 6 ECTS)

Course Content: This course includes the advanced topics of power electronics such as some of the latest devices their control and applications. This course will be covered in five modules.
I: Advanced solid state devices such as MOSFETs, IGBT, GTO, IGCT etc, intelligent power modules, thermal design, protection, gating circuits, DSP used in their control. II: Non-isolated and isolated DC-DC converters such as buck, boost, buck-boost, flyback, forward, Cuk, SEPIC, half bridge, push-pull and bridge in DCM and CCM, power factor correction at AC mains in these converters, their application in SMPS, UPS, welding and lighting systems. III: Improved power quality AC-DC converters. IV: Conventional HVDC (High voltage direct current), VSC based flexible HVDC systems. V: The fifth module consists of solid state controllers for motor drives such as vector control and direct torque control of induction motor, synchronous motor, permanent magnet sine fed motor, synchronous reluctance motor, permanent magnet brushless DC (PMLDC) motor, LCI (load commutated inverter) fed large rating synchronous motor drives, energy conservation and power quality improvement in these drives.
Objectives: In this course, students will be introduced to the latest power electronic devices and their applications in power conversion systems.
Learning outcomes: On successful completion of this unit a learner will: Understand semiconductor devices in power electronic systems Understand the operation of electronic power converter circuits Understand application and implementation issues of power electronic systems Understand solid state controllers for motor drives such as vector control and direct torque control of induction motor etc.
Literature:

1. N. Mohan, T. M. Undeland and W. P. Robbins, "*Power Electronics, Converter, Application and Design*", Third Edition, John Willey & Sons, 2004.
2. M. H. Rashid, "*Power Electronics, circuits, Devices and Applications*", Pearson, 2002, India.
3. Bin Wo, "*High Power Convertes and AC drives*", IEEE press, 2006
4. B. K. Bose, "Power Electronics and Variable Frequency Drive", Standard Publishers Distributors, 2000.

Course title: Introduction of Theory of Energy Market (Elective, Sem II, 6 ECTS)
The goal: Understanding new electric power companies' structures. Knowledge about System operator role and importance in open market environment.Understanding connection between ancillary services market design and insurance of stabile and secure power system operation.
Learning Outcomes On successful completion of the course, students will be able to: 1. Define most important terms relevant to electricity market 2. Differentiate vertical and horizontal organization of electric power 3. Enumerate and describe market, regulated and possible market activities 4. Explain market different design and organization 5. Enumerate market subjects and describe their role in market environment 6. Describe functioning of ancillary systems market 7. Describe market power 8. Argue influence of congestion on electricity price
Course content: Power sector restructuring (organizational structures before and after). Implementation of classical economic theory on electric power (liberalization, deregulation, reregulation, privatization). Market different and organization (wholesale, spot, futures, forward, balancing, bilateral). Electric power market and ancillary systems market. Power (PX). Auction Types. System operators (minimal and maximal). Costs (marginal, opportunity, stranded, variable, total?). Influence of services market i.e. price of electricity. Systems for measurement and accountings in environment. Mandatory and commercial services. Market power. Congestion as results of market.
Methodology of teaching:45 hours of lectures, 25 hours numerical exercises. Approximately 100 hours of independent work including thesis seminar.
Grading System: Seminar 10%, intermediate estimates 30%, final exam 60%.
Literature

1. S. Tešnjak, E. Banovac, I. Kuzle (2009). Tržište električne energije, Graphis, Zagreb, Hrvatska

2. K. Shahidehpour, M. Alomoush (2001). Restructured Electrical Power Systems, Marcel Dekker, Inc., New York, USA
3. S. Stoft (2002). Power System Economics - Designing Markets for Electricity, IEEE Press/John Wiley&Sons, New York, USA
4. G. Rothwell, T. Gomez (2003). Electricity Economics: Regulation and Deregulation, IEEE
5. Press/John Wiley&Sons, New York, USA
6. B. Murray (1998). Electricity Markets ? Investment Performance and Analysis, John Wiley&Sons, New York, USASimilar Courses

Course Title: Energy management (Elective, Sem II, 6 ECTS)
The goal: This module covers information that will provide the learner to gain knowledge, skill and competence to investigate, analyze and evaluate, develop and implement energy management strategies in different energy sectors. It enables students to understand the techniques to develop a professional role in energy audit and management along financial appraisals.
Learning outcomes: On completion of this module, the learner will be able to: • Develop an efficient audit and energy management program. • Seek, process and interpret information • Analyze critically by using computer applications • Proposes solution and associated payback periods • Produce an energy policy for occupants and the energy audit report
Course Content: Energy audit, surveys, site measures, monitoring and targeting etc • The Principles of energy management and justification of investments • Energy Management Standards, ISO 50001 • Solving problems using a rational approach • Involvement of staff: the people issues and implementations of measures • Essential information about related EU Directives and Energy Labeling Case studies
Methods of teaching: 30 hours of lectures, 15 hours of numerical exercises, 15 hours of tutorial
Grading system: Seminar works 40%, A final examination 60%
Basic literature:

1. http://www.energyinst.org/_uploads/documents/EnergyManagementTrainingBrochure.pdf
2. http://www.indep.info/documents/15763_INDEP%20-%20Eficienca%20e%20Energjise%20ne%20Kosove.pdf
3. http://mzhe.rks-gov.net/repository/docs/Regullorje_nr_01_2012_themelimin_dhe_funksionimin_e_komisionit_per_certifikim_te_auditorve_dhe_menaxhereve_te_energjise2.pdf

Course title: Methodology of scientific research (Elective, Sem II., 6 ECTS)
Course objectives: To introduce some key elements of research methodology to first time research students.
Learning outcomes: At the end of this course, the students should be able to: understand some basic concepts of research and its methodologies, identify appropriate research topics, select and define appropriate research problem and parameters, prepare a project proposal (to undertake a project), organize and conduct research (advanced project) in a more appropriate manner, write a research report and thesis, write a research proposal (grants).
Course content: Overview of experimental and engineering methodological approaches to research; Basics of research design (e.g., hypothesis formulation); The research process: documenting research, sources of information, research funding, creativity and intellectual discovery; Guidelines and a framework for efficient development of research; legal and ethical issues; protecting and exploiting research; Intellectual Property rights; Managing the research project: supervision, planning and organization; problems and pitfalls; Presentation skills (written, oral); Use of relevant research tools (technology, experimental infrastructure, mathematical methods, etc.).

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. Kothari B.L., "*Research Methodology: Tools and Techniques*", New Age International Publishers, 2009.
2. Boot C. W., "*The Craft of Research*", University Of Chicago Press, 2008.

Elective Courses:Electrical Drives and Machines

Course title: Advanced Power Electronics (Elective, sem.II. 6 ECTS)
Course Content: This course includes the advanced topics of power electronics such as some of the latest devices their control and applications. This course will be covered in five modules.
I: Advanced solid state devices such as MOSFETs, IGBT, GTO, IGCT etc, intelligent power modules, thermal design, protection, gating circuits, DSP used in their control. II: Non-isolated and isolated DC-DC converters such as buck, boost, buck-boost, flyback, forward, Cuk, SEPIC, half bridge, push-pull and bridge in DCM and CCM, power factor correction at AC mains in these converters, their application in SMPS, UPS, welding and lighting systems. III: Improved power quality AC-DC converters. IV: Conventional HVDC (High voltage direct current), VSC based flexible HVDC systems. V: The fifth module consists of solid state controllers for motor drives such as vector control and direct torque control of induction motor, synchronous motor, permanent magnet sine fed motor, synchronous reluctance motor, permanent magnet brushless DC (PMLDC) motor, LCI (load commutated inverter) fed large rating synchronous motor drives, energy conservation and power quality improvement in these drives.
Objectives: In this course, students will be introduced to the latest power electronic devices and their applications in power conversion systems.
Learning outcomes: On successful completion of this unit a learner will: Understand semiconductor devices in power electronic systems Understand the operation of electronic power converter circuits Understand application and implementation issues of power electronic systems Understand solid state controllers for motor drives such as vector control and direct torque control of induction motor etc.
Literature:

1. N. Mohan, T. M. Undeland and W. P. Robbins, "*Power Electronics, Converter, Application and Design*", Third Edition, John Willey & Sons, 2004.
2. M. H. Rashid, "*Power Electronics, circuits, Devices and Applications*", Pearson, 2002, India.
3. Bin Wo, "*High Power Convertes and AC drives*", IEEE press, 2006
4. B. K. Bose, "Power Electronics and Variable Frequency Drive", Standard Publishers Distributors, 2000.

Course title: Special chapters from electrical machines, (Elective, Sem II, 6 ECTS)
The goal: The aim of this course is to provide advance knowledge on special chapters of transformers and rotating electric machines.
Learning outcomes: After completion of this course the student will have the advance knowledge for Transformers and alternative rotating electric machines 2. Non-symmetrical regimes in transformers and alternative rotating electric machines,
Course content: Three phase transformers with two windings; non-symmetrical regimes, method of symmetrical component, the equivalent scheme for direct, inverse and zero sequence. Currents, voltages

of the transformer in operation with asymmetric load. Higher harmonics of no lord current. Inductive machines, non-symmetrical regimes, method of symmetrical component, the equivalent scheme for direct, inverse and zero sequence. Higher harmonics and performance of induction machines. Synchronous machines, method of symmetrical component, the equivalent scheme for direct, inverse and zero sequence. Non-symmetrical load of synchronous generator, current of non non-symmetrical short circuit, consequences of non-symmetrical load. Oscillation and dynamic stability of synchronous generator. Asynchronous regimes of synchronous generators.
Methods of teaching: 30 hours of lectures, 30 hours of numerical exercises. Approximately 80 hours of personal study and exercise including seminars.
Grading System: Seminar 20%, Mid-term exams 30 %, Final Exam 50 %
Literature:

1. Nysret Avdiu, Transformatoret dispencë 2009 Prishtinë
2. H. Maliqi, Regjimet josimetrike në makina Elektrike, Prishtinë 1986
3. 1. N.Xhoxhi, Y.Luga Makinat elektrike 1,2,3, 1991

Course title: Control of Electrical Drives (Elective, Sem. II, 6 ECTS)
The goal: The course goal is to provide advance knowledge for control of electrical drives.
Learning outcomes: On successful completion of the course, students will know: 1. Electrical drives control principles, 2. Control of asynchronous motors, vector and scalar control, 3. ontrolMotorve synchronous control.
Course content: Introduction. Eelements of electrical drive system. Mechanical system. Electric supply. Controllers and convertors of energy. Dq modeling of induction machines –rotating systems in stator, rotor and system rotating with synchronous speed; equations with space vector, principles of control of electrical drives with induction machines, vector control, scalar control. Basic principles of control of synchronous motors.
Methods of teaching: 30 hours of lectures + 30 hours of auditorial exercises and seminars . Approximately 80 hours of personal study and exercise including seminars.
Grading System: Seminar 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. R Krishnan, Electric Motor Drives, PHI-2001.
2. D W Novotny and T A Lipo, Vector Control and Dynamics of AC Drives, Oxford University Press, 1996.
3. B K Bose, Modern Power Electronics and AC Drives, Pearson-2002.
4. Leonhard, Control of Electric Drives, Springer-2001.
5. Kazmierkowski, Krishnan, Blaabjerg, Control in Power Electronics-Selected Problems, Academic Press, 2002.

Course title: Methodology of scientific research (Elective, Sem II., 6 ECTS)
Course objectives: To introduce some key elements of research methodology to first time research students.
Learning outcomes: At the end of this course, the students should be able to: understand some basic concepts of research and its methodologies, identify appropriate research topics, select and define appropriate research problem and parameters, prepare a project proposal (to undertake a project), organize and conduct research (advanced project) in a more appropriate manner, write a research report and thesis, write a research proposal (grants).
Course content: Overview of experimental and engineering methodological approaches to research; Basics of research design (e.g., hypothesis formulation); The research process: documenting research,

sources of information, research funding, creativity and intellectual discovery; Guidelines and a framework for efficient development of research; legal and ethical issues; protecting and exploiting research; Intellectual Property rights; Managing the research project: supervision, planning and organization; problems and pitfalls; Presentation skills (written, oral); Use of relevant research tools (technology, experimental infrastructure, mathematical methods, etc.).
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. Kothari B.L., "*Research Methodology: Tools and Techniques*", New Age International Publishers, 2009.
2. Boot C. W., "*The Craft of Research*", University Of Chicago Press, 2008.

Course name: Protection and Security of Power System (Mandatory, Sem III, 6 ECTS)
Course objectives: To achieve the theoretical and practical knowledge's about Power System Protection.
Learning Outcomes: After completion of this course, student should be able to calculate fault quantities in Power System elements, to design appropriate protection for each element: generator, transformer, bus bar and line protections.
Course Content Main *characteristics in relay protection*. Calculation of fault quantities in Power System elements. *Protection of medium and large: generators, power transformers, bus bars and electrical lines.* Coordination of protective relays in electrical lines for phase and ground faults. *Over current, directional, distantional and differential protections and design.*
Teaching methodology: 30 hours lectures, and 30 hours with solution of problems. Approximately 60 hours with lecturer and teaching assistant.
Assessments: 3 tests each one 20 %, and final exam 40 %.
Literature:

1. A. Gashi, Mbrojtja rele, ligjëratat dhe prezantimet 2013.
2. L.G. Hewitson, Mark Brown, R. Balakrishnan, Power System Protection, ELSEVIER, 2004.
3. J.L. Blacburn, Protective relaying-Principles and applications, Taylor and Francis Group, 2003, London
4. ABB Protection Course 2007.

Course title: Energy Economics (Mandatory, Sem III, 6 ECTS)
The goal: Fundamental knowledge about electricity as a commodity, its economic value and market position. Insight in the operation of today's electricity markets.
Understanding of energy sources scarcity and relation between economic development and energy consumption
Learning Outcomes: On successful completion of the course, students will be able to: 1. Explain historical and actual occurrences and cause-effect relationships in the world energy market 2. Distinguish between different electricity market participants, their strategic goals and rationale for decision making in market conditions 3. Estimate risks and applicability of different mechanisms for reducing risks related to participation in electricity market 4. Demonstrate the impacts of physical characteristics of electricity on the market 5. Compare different investment options in the power system according to their cost – effectiveness in market conditions 6. Choose adequate market strategy according to the type of market participant conditions.
Course Description: Relationship between energy consumption and economic growth. Overview of the distribution of energy resources, demand, supply and trade across the world.

Economics of exhaustible resources and its application to energy sector. Key concepts from the theory of the firm with application to energy sector. Energy markets – liberalization and deregulation. Complexity of competitive electricity market. Organization of electricity markets. Participants in electricity markets. Risks of participating in electricity markets. Types of markets and contracts. Ancillary services market. Powers systems limitations and their impacts on electricity prices. Methods for evaluating cost – effectiveness of investments. Investing in electricity production. Investing in energy efficiency improvements as a new energy source. Investing in transmission. Energy strategies in market conditions.
Methodology of teaching: 45 hours of lectures, 15hours numerical exercises. Approximately 100 hours of independent work including thesis seminar.
Grading: Seminar 10%, intermediate estimates 30%, final exam 60%.
Literature

1. Daniel S. Kirschen, Goran Štrbac (2004). Fundamentals of Power System
2. Economics, WileyIvar Wangesteen (2007).
3. Power System Economics – The Nordic Electricity Market, Tapir Academic Press
4. Carol A. Dahl (2004). International Energy Markets – Understanding Pricing, Policies and Profits, Similar Courses
5. Power Economics in the Liberalized Electricity Markets, RWTH Aachen

Elective courses: Electric Power Systems

Course title: ***Distribution Networks and Distribution Generation*** (Elective, Sem. III, 6 ECTS)
The goals: The purpose of the course is to gain knowledgeof planning, design and operation of passive distribution networks. Planning, design and operation of passive distribution networks, and planning, design and operation of distributed generation.
Learning outcomes: On successful completion of the course, students will be able to: 1. Explain and give example of electricity distribution business. 2. Explain operation and function of electricity distribution within electric power system. 3. Assemble electricity distribution network. 4. Analyze and forecast load demand in distribution networks. 5. Analyze and planinng of electricity distribution networks. 6. Design of electricity distribution networks with integrated distributed Generation. 7. Evaluate impact of distributed generation on operation of electricity distribution networks.
Course content: Configuration of distribution networks. Load forecasting, Analysis of the distribution networks. Building and operation. Network elements. Substation design. Voltage regulation and reactive compensation in distributed networks. Quality of supply. Analysis and calculation of distribution networks. Active distribution network. Distributed resources. DG impact on planning and operation. Micro-grids and VPP. DG and network security. Economics of DG. Introduction to network optimization.
Methods of teaching: 30 hours of lectures + 30 hours of auditoria exercises. Approximately 100 hours of personal study and home exercises.
Grading System: First exams 15%, Second exams 15 %, Home exercises (design) 15%. Final Exam 55 %
Literature:

1. William H. Kersting, Distribution System Modeling and Analysis, CRC Press, 2002
2. H. Lee Willis; Walter G. Scott, Distributed Power Generation: Planning and Evaluation, Marcel Dekker, 2000.
3. N. Jenkins, J.B. Ekanayake and G. Srtbac, Distributed Generation, IET, 2010
4. S. Chowdhury, S.P. Chowdhury, and P. Crossley, Microgrids and Active Distribution Networks, IET, 2009.

Course title:Power system Supervision and remote control (Elective, Sem.III, 6 ECTS)
The goals: The purpose of the course is to gain knowledge of automation in power system.
Learning outcomes: On successful completion of the course, students will be able to:1. Describe the procedure of determining the level of automation in electrical powersystem. 2. Procean automation and technics using binary logic, and create the logical circuit using logical blocks. 3. Relay techninc in power system and progrming in relay 4. PLC Programming, protocols and standrads used on communication in power system. 5. Standardprocesscommunication bus(PROFI, BIT, CAN, LON, MOD-, EI-, M-Bus).
Course content: Architectureof automatic controlof Switchgear.Interfacewith the process-binary, pulse, analog signalsandcommands. Sensorsand actuators. Transducers. Localautomationdevices-fixedwiredandprogrammable. Relay technique. Electroniclogic circuits. Programmable logiccontrollers-PLC. PLC programming. IEC1131standard.Soft-PLC. Distributedlocalautomationin electricalinstallations.Standardprocesscommunication bus(PROFI, BIT, CAN, LON, MOD-, EI-, M-Bus). Human-process. Process visualization.
Methods of teaching: 30 hours of lectures + 30 hours of auditoria exercises. Approximately 100 hours of personal study and home exercises.
Grading System: First exams 15%, Second exams 15 %, Home exercises (design) 15%, Regular continuation 5%. Final Exam 50 %
Literature:

1. Programmable Controllers; E.A. Parr; Newnes; 2003; ISBN: 0 7506 5757 X
2. Programmable Logic Controllers: Programming Methods and Applications; John R. Hackworth, Frederick D. Hackworth, Jr.; Pearson/Prentice Hall; 2004; ISBN: 0130607185, 9780130607188
3. Programmable Logic Controllers; W. Bolton; Newnes; 2009; ISBN: 1856177513, 9781856177511
4. Programmable Logic Controllers: Principles and Applications; John Webb, Ronald A. Reis; Prentice Hall; 1999; ISBN: 0136794084, 9780136794080
5. Programmable logic controllers; Frank D. Petruzella; McGraw-Hill Higher Education; 2004; ISBN: 0078298520, 9780078298523

Course title: Design and construction of power systems (Mandatory, Sem III, 6 ECTS)
The goal: The course addresses a complete variety of substation design subjects at a level to those relatively new to the area of substation design. It introduces requirements, configuration philosophies, design practices, information sources and work processes.
Learning Outcomes: On successful completion of the course, students will be able to: 1. Describe electrical blueprints, 2. Analyze current transformers, 3. Analyze voltage transformers, 4. Analyze substation technical requirements, 5. Choose substation elements (bus bar, switching devices, transformers, cables, grounding), 6. Apply knowledge about substation system design.
Course Content: Structure of the electric power system, Classifications, Standards. IEC standards. Equipment definitions and terminology. Design principles. Substation project chronology. Workflow and project sequence. Planning. Engineering design, drawings and documentation (CAD). Construction, testing and commissioning. Costs and Financial Analysis. Schedules and Impacts. Substation Grade Types. Design techniques. Bus configurations, Reliability criteria. Insulation and insulation protection. General specification and ratings of power equipment. Transformers. Circuit breakers. Switches. Disconnectors. Ancillary equipment. Potential and current transformers. Substation auxiliary systems. Grounding. Grounding design considerations.
Methodology of teaching: 45 hours of lectures, 30 hours numerical exercises. Approximately 100 hours of independent work including thesis seminar.
Grading System: Seminar 10%, intermediate estimates 30%, final exam 60%.
Literature:

1. Computer-aided design for electrical power substations Yi-Nung Chung Lamar University 1986
2. Electric Power Substations Engineering J.D. McDonald CRC Press 2001

Course title: ***Power Quality*** (Elective Sem. III, 6 ECTS)
The goals: The purpose of the course is to gain knowledgeof power quality problems, knowledge about disturbance sources and their influence on the end users. Ability to perform in-situ measurements and practical skills to analyze measuring results and proposing measures to improve power quality.
Learning outcomes: On successful completion of the course, students will be able to: 1. Define the term power quality. 2. Explain the security of supply. 3. Describe parameters of voltage quality. 4. Select legislation and standards regarding the power quality. 5. Recognize the impact of harmonics on supply quality. 6. Describe measuring procedure of voltage quality. 7. Explain measures to improve the quality of power supply
Course content: Power Quality definition. European standards and recommendations. Harmonics. Voltage variations and flickers. Voltage unbalance. Power factor. Power quality measurements. Measuring instrumentation and equipment. Applied measures for power quality improvement. Including Power quality in distribution planning and operation.
Methods of teaching: 30 hours of lectures + 15 hours of auditoria exercises + 15 hours of laboratorz exercises. Approximately 90 hours of personal study and home exercises.
Grading System: First exams 15%, Second exams 15 %, Home exercises (design) 15%, Regular continuation 5%. Final Exam 50 %
Literature:

1. M. H. J. Bollen; Understanding Power Quality Problems: voltage sags and interruptions, IEEE Press, 2000
2. R. C. Dugan, M.E. McGranaghan, S. Santoso, H.W.Beaty, Electrical Power System Quality, McGraw Hill, 2003.
3. Barry W. Kennedy, Power Quality Primer, McGraw Hill, 2000

Course title: Smart Grids (Elective,Sem III., 6 ECTS)
Course objectives: To introduce some key elements of smart grids. To understand the interaction of various disciplines in smart grids. After completing the course the student should have a thorough knowledge of historical, institutional, and technical understanding of the current electric transmission and distribution grid and existing theories and methods in the field of smart grid.
Learning outcomes: At the end of this course, the students should be able to:

- Understand some basic concepts of Smart Metering technology and Smart grids,
- Explain and recognize about grid automation, the integration of renewables, the impacts of electric vehicles (EVs),
- Explain and recognize about networking skills that are applied in the power systems area,
- Explain and recognize about developing control solutions for power system applications.
- Students will learn to analyse existing theories and methods in the field of smart grid.
- Students will be able to apply and communicate their knowledge and skills in new areas.

Course content: A basic historical, institutional, and technical understanding of the current electric transmission and distribution grid and other power system. Benefits and liabilities associated with the

Smart Grid concept. Tools, techniques, and critical thinking concepts used in making trade-offs in the Smart Grid environment Renewable energy resources and environmental impacts. The role of information technology in advancing the Smart Grid. Emerging Smart Grid business opportunities. The challenges of introducing new technologies associated with the Smart Grid.
The topics for the Smart Grid course are divided into four parts: power systems, computer networking and communications, environmental and economic issues, and controls.
Power Systems: Introduction to power systems; Power system transients and stability; Outage management; Signal processing in power systems; Smart sensors/synchrophasors/telemetry; System performance/reliability; Estimation theory
Computer Networking and Communications: Introduction to communication networks; Communication requirements for smart grids; Existing smart grid communication standards; Hybrid communication systems for smart grids; Advanced metering infrastructure; Information security and privacy; Network protocol development and performance evaluation for smart grids
Environmental and Economic Issues: Distributed energy sources/microgrids/demand response; Environmental impacts; Economics of alternative fuels
Controls: Decentralized and distributed control; Multiobjective optimization; Real-time 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. James Momoh, *Smart Grid: Fundamentals of Design and Analysis*, Wiley-IEEE Press, 2012
2. Fereidoon P. Sioshansi, *Smart Grid: Integrating Renewable, Distributed & Efficient Energy*, Academic Press, 2011
3. *Smart Grids: Technologies, Applications and Management Systems*, Editor Lindsey Michelle Koga, Nova Science Pub Inc, 2014
4. Daphne Mah, Peter Hills, Victor O.K. Li and Richard Balme, *Smart Grid Applications and Developments (Green Energy and Technology),* Springer, 2014
5. Stephen F. Bush, *Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid*, Wiley - IEEE, 2014

Elective courses: Renewable Resources,Energy Efficiency and Energy Economics

Course title: Energy and environment (Elective , sem III, 6 ECTS)
The goal: The aim (goal) of this module is to provide the learner with the necessary knowledge, skill and competence in the broad area of energy and the environmental issues. It enables the student to evaluate the impact of energy in the environmental in technical, economic and political terms.
Learning outcomes: On successful completion of the course, students will be able to:

- Explain and recognize about energy and development of society, energy sources and there use, impacts on human and environment of electricity production
- Explain Earth Atmosphere: content of earth atmosphere, physical and chemical processes and influence of sulphur and nitrous oxides in atmosphere and regulations and international agreements in the field of environmental protection in energy sector
- Explain ozone layer and importance for live on earth, principles for destroying of ozone and what are ozone holes
- Explain the Greenhouse effect and emissions of the greenhouse gases, possibilities for CO2 reduction, international agreements for mitigation of the greenhouse gases and climate changes
- Evaluate and calculate emissions into air from for fossil fuels plants and technologies for emissions reduction in electricity production to air from combustion

- Explain and evaluate solid and liquid waste from fossil fuel power plants and understand methodology for selection of power plants locations
- Explain and evaluate nuclear radiation and Environmental impact of nuclear power plants fuel cycle and decommission and disposal of low level radioactive waste and used nuclear fuel

Course Content: Energy and Development of society. Energy sources and their utilization potentials. Environmental impact of energy sector. Earth atmosphere in history. Ozone layer and important for live on Earth. Global warming and emissions of greenhouse gasses, possibilities for reduction. Climate changes. Electricity production and impact to human health and environment. Technical and economic characteristics of emission abatement technologies. Environmental regulations, standards and international agreements. Method for power plant location selection. Impact of NPP on environment: during normal operation, accidents, fuel cycles. Emission reduction costs. Sustainable development: history, definitions, goals. Sustainable development indicators: what are, purposes. Energy and sustainable development. Energy chains environmental impact. External costs. Instruments for emission reduction. Optimization of emission reduction level.

Methodology of teaching: 30 hours of lectures, 15 hours of numerical exercises

Grading System: Seminar works 40%, A final examination 60%

Literature:

1. James. A. Fay, Daniel. S. Golomb, *Energy and The Environment*, Oxford University Press, 2011.
2. Robert A. Ristinen, Jack P. Kraushaar, *Energy and The Environment*, John Wiley & Sons, 2006.
3. D. Feretić, Z. Tomšić, D. Škanata, N. Čavlina, D. Subašić, *Elektrane i okoliš*, Element Zagreb, 2000.
4. J.W. Tester, E.M. Drake, M.W. Golay, M.J. Driscoll, and W.A. Peters, *Sustainable Energy: Choosing Among Options*, Massachusetts Institute of Technology, 2005.

Course title: Energy management and energy efficiency (Elective, Sem III, 6 ECTS)

The goal: This module covers information that will provide the learner to gain knowledge, skill and competence to investigate, analyze and evaluate, develop and implement energy management strategies in different energy sectors. It enables students to understand the techniques to develop a professional role in energy audit and management along financial appraisals.

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

- Explain and recognize about production of energy sources and consumption of energy in the world and in Kosovo, Albania and Macedonia
- Apply and analyze methodology of energy management in industry
- Conclude and explain policy of energy efficiency in EU and recommendations for energy efficiency policy.
- Explain barriers for implementation of energy efficiency measures
- Analyze the relationship between energy use and production volume
- Analyze and evaluate consumption and recommend energy efficiency measure for electricity systems (tariffs, consumption of reactive power, lighting, motors)
- Evaluate consumption and recommend energy efficiency measure for energy system in industry: pumps, fans, compressed air, fuels, combustion and boilers, steam system

Course Content: Energy situation in the world and in Kosovo, Albania and Macedonia. Energy resources, energy transformations and direct consumption of energy (efficient usage of energy in industry and buildings). Demand side management and its value. Basic types of energy consumption and energy management strategy in industry and buildings. Possibilities for improvements and for financing of energy efficiency programs. Energy management in industry and buildings. Technical and human components of energy management programs. Principles for implementation of energy management and environment protection programs, motivation, leadership and team work models. Regulation of energy

sector and organization of energy market. Economical and social regulation. Regulatory bodies. Regulation of monopoly or public service. Regulation of energy subjects entrance in the sector and control of energy market operation. Control of quality standards implementation. Energy trading on the liberalised energy.
Methods of teaching: 30 hours of lectures, 15 hours of numerical exercises, 15 hours of tutorial
Grading system: Seminar works 40%, A final examination 60%
Basic literature:

1. Frank Kreith, D.Yogi Goswami, *Handbook of Energy Efficiency and Renewable Energy*, CRC, Taylor / Francis Group, 2007.
2. Frank Kreith, Ronald E. West, CRC *Handbook of Energy Efficiency*, CRC Press, 1997.
3. Albert Thumann; William J. Younger, Terry Niehus, *Handbook of Energy Audits, Eighth Edition*, CRC Press, 2009.
4. Wayne C. Turner, Steve Doty, *Energy Management Handbook, 7th edition*, Fairmont Press, 2009.

Course Title: Energy management (Elective, Sem III, 6 ECTS)
The goal: This module covers information that will provide the learner to gain knowledge, skill and competence to investigate, analyze and evaluate, develop and implement energy management strategies in different energy sectors. It enables students to understand the techniques to develop a professional role in energy audit and management along financial appraisals.
Learning outcomes: On completion of this module, the learner will be able to: • Develop an efficient audit and energy management program. • Seek, process and interpret information • Analyze critically by using computer applications • Proposes solution and associated payback periods • Produce an energy policy for occupants and the energy audit report
Course Content: Energy audit, surveys, site measures, monitoring and targeting etc • The Principles of energy management and justification of investments • Energy Management Standards, ISO 50001 • Solving problems using a rational approach • Involvement of staff: the people issues and implementations of measures • Essential information about related EU Directives and Energy Labeling Case studies
Methods of teaching: 30 hours of lectures, 15 hours of numerical exercises, 15 hours of tutorial
Grading system: Seminar works 40%, A final examination 60%
Basic literature:

1. http://www.energyinst.org/_uploads/documents/EnergyManagementTrainingBrochure.pdf
2. http://www.indep.info/documents/15763_INDEP%20-%20Eficienca%20e%20Energjise%20ne%20Kosove.pdf
3. http://mzhe.rks-gov.net/repository/docs/Regullorje_nr_01_2012_themelimin_dhe_funksionimin_e_komisionit_per_certifikim_te_auditorve_dhe_menaxhereve_te_energjise2.pdf

Course title: Smart Grids (Elective,Sem III., 6 ECTS)
Course objectives: To introduce some key elements of smart grids. To understand the interaction of various disciplines in smart grids. After completing the course the student should have a thorough knowledge of historical, institutional, and technical understanding of the current electric transmission and distribution grid and existing theories and methods in the field of smart grid.
Learning outcomes: At the end of this course, the students should be able to:

- Understand some basic concepts of Smart Metering technology and Smart grids,

- Explain and recognize about grid automation, the integration of renewables, the impacts of electric vehicles (EVs),
- Explain and recognize about networking skills that are applied in the power systems area,
- Explain and recognize about developing control solutions for power system applications.
- Students will learn to analyse existing theories and methods in the field of smart grid.
- Students will be able to apply and communicate their knowledge and skills in new areas.

Course content: A basic historical, institutional, and technical understanding of the current electric transmission and distribution grid and other power system. Benefits and liabilities associated with the Smart Grid concept. Tools, techniques, and critical thinking concepts used in making trade-offs in the Smart Grid environment Renewable energy resources and environmental impacts. The role of information technology in advancing the Smart Grid. Emerging Smart Grid business opportunities. The challenges of introducing new technologies associated with the Smart Grid.
The topics for the Smart Grid course are divided into four parts: power systems, computer networking and communications, environmental and economic issues, and controls.
Power Systems: Introduction to power systems; Power system transients and stability; Outage management; Signal processing in power systems; Smart sensors/synchrophasors/telemetry; System performance/reliability; Estimation theory
Computer Networking and Communications: Introduction to communication networks; Communication requirements for smart grids; Existing smart grid communication standards; Hybrid communication systems for smart grids; Advanced metering infrastructure; Information security and privacy; Network protocol development and performance evaluation for smart grids
Environmental and Economic Issues: Distributed energy sources/microgrids/demand response; Environmental impacts; Economics of alternative fuels
Controls: Decentralized and distributed control; Multiobjective optimization; Real-time 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:

6. James Momoh, *Smart Grid: Fundamentals of Design and Analysis*, Wiley-IEEE Press, 2012
7. Fereidoon P. Sioshansi, *Smart Grid: Integrating Renewable, Distributed & Efficient Energy*, Academic Press, 2011
8. *Smart Grids: Technologies, Applications and Management Systems*, Editor Lindsey Michelle Koga, Nova Science Pub Inc, 2014
9. Daphne Mah, Peter Hills, Victor O.K. Li and Richard Balme, *Smart Grid Applications and Developments (Green Energy and Technology),* Springer, 2014
10. Stephen F. Bush, *Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid*, Wiley - IEEE, 2014

Elective Courses:Electrical Drives and Machines

Course title: Small engines, (Elective, sem III, 6 ECTS)
The goal: The aim of this course is to provide general knowledge on special small electrical machines applicable in industry and automatic control.
Learning outcomes: After completion of the course the student will have the knowledge for
1. Type of small electrical machines and special electrical machines,
2. Electromagnetic parameters and work performance of special electrical machines.

Course content: General knowledge of special electrical machines and small electrical machines. Construction feature and theory. Electrical micro-machines without collector, theory. Step motors, parameters. Theory and construction of micro-motors with permanent magnet. Mathematic modeling of micro-machines.

Methods of teaching: 30 hours of lectures, 30 hours of numerical exercises. Approximately 70 hours of personal study, including seminars.
Grading System:
Seminar 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. J. F. Gieras, R. J. Wang, M. J. Kamper, Axial Flux Permanent Magnet Brushless Machines, Kluwer Academic Publishers, Dordrecht, 2004.
2. S. A. Nasar, I. Boldea, L. E. Unnewehr, Permanent Magnet, Reluctance, and Self-Synchronous Motors, CRC Press, London, 1993.
3. T. J. E. Miller, Brushless Permanent-Magnet and Reluctance Motor Drives, Oxford Science Publications, Oxford, 1989.
3. Sergey E. Lyshevski, "Electromechanical Systems, Electric Machines, and Applied Mechatronics", CRC Press, Boca – Raton – London – New York – Washington D.C., 2000.
4. B.S. Guru, H. R. Hiziroğlu, "Electric Machinery and Transformers", 3rd Edition, Oxford University Press, New York – Oxford, 2001.

Course title: Modeling and Simulation of Electrical Drives (Elective, Sem III, 6 ECTS)
The goal: The aim of this course is to give basic knowledge on the modeling and simulation of advanced control techniques of electric drives. Initially, the dynamic models of the dc and ac motors are developed that will be useful in understanding the modeling and simulation of advanced electric drives control. Since majority of modern drives are ac motor drives, the course centers around the control of ac motor drives: vector and scalar control.
Learning outcomes: After completing this course the student will be able to:
1. know the basic of dc and ac electrical drives, modelin and simulation,
2. know the fundamental principels of modeling of unregulated electric drives,
3. know the fundamental principels of modeling of regulated advanced electric drives,
4. know the principles of vector control of iduction motor, modeling and simulation
5. know the principles of scalar control of iduction motor, modeling and simulation
6. know about the direct torque and flux control of induction machine, sensorless control and flux observers.

Course content: Generalized theory of electric machines, Kron's primitive machine, modeling of dc machines, induction machine, scalar and vector control of induction machine, direct torque and flux control of induction machine, sensorless control and flux observers.
Methods of teaching: 45 hours of lectures, plus 20 hours of exercises, on modeling and simulation, and 30 hours two seminars. Approximately 100 hours of personal study.
Grading System:
Seminars 20%, Mid-term exams 20 %, Final Exam 60 %
Literature:

1. Peter Vas, "Vector control of Ac machines", Oxford University Press, 1990.
2. Leonard, W,"Control of Electric Drives", Springer Verlag, 1985.
3. R.Krishnan ,"Electric motor drives: Modelling , Analysis and Control".PH ,1998
4. D.W. Novotny, T.A. Lipo, "Vector Control and Dynamics of AC Drives", 1997.
5. I. Boldea, *Electric Drives*, CRC Press 1999.

Course title: CAD in Electrical Machines (Elective, Sem. III, 6 ECTS)
The goal: The course goal is to give the general knowledge for design of power electrical transformer and rotating electrical machines.
Learning outcomes: On successful completion of the course, students will know: 1. the basic concepts on which are based the design of the transformator, 2. the basic concepts on which are based the design of the rotating electrical machines.
Course content: Advanced theory of direct current machines, synchronous machines, asynchronous machines and transformers. Theoretical and technological aspects of the design of the magnetic cores of electrical machines and transformers. A general overview of the materials used for the design of electrical machines. Modern developments in the design of electrical machines. Laws and similarities in dimensioning of electrical machines. Heating and cooling of electrical machines. Examples in design of transformers and electrical machines.
Methods of teaching: 30 hours of lectures + 30 hours of auditorial exercises . Approximately 80 hours of personal study and exercise including seminars.
Grading System: Seminar 40%, Mid-term exams 10 %, Final Exam 50 %
Literature:

1. E. Wiedemann, W. Kellenberger: Konstruktion elektrischer Machinen, Springer-Verlag, Berlin-Heidelberg-New York, 1967.
2. M. Ramamoorty: Computer - Aided Design of Electrical Equipment, Ellis Horwood Limited, England, 1998.

Course title:Transient regimes in electrical drives (Elective, Sem. III, 6 ECTS).
The purpose: The purpose of the course is to prepare students to work independently on analysing of transient regimes of electrical drives and their special applications.
Learning outcomes: On successful completion of the course, the student will be able to: (i) appropriatelly select and dimension the electrical machines based on concrete industrial applications needs and requirements; (ii) analyse the dinamics of electrical drives and their consequences; (iii) calculate and analyse in details the electrical drives and their applications; (iv) have sufficient knowledge on modern applications of the drives and ability to propose the replacement of obsolete electrical drives by the new modern and more efficient applications.
Course content: Electrical drives with AC machines with collectors Technical and economical analyses. Modern controll application of electrical drives (Voltage and current source inverters. Ciclo-converters. Microprocessors. etc.). Transient regimes in DC electrical drives (transient regimes in Leonard drive system). Transient regimes in AC drives. (Graphic and grapho-analitic solutions. Load changes. Transient regimes in high power industrial drives). Transient regimes in sinchronous drives. Reduction of losses in transient regimes. Transient regimes and laws of the similarity of electrical motors. Dynamic stability. Selection of the electrical motor. Theory of heating. Method of the average value of losses. Method of equivalent current, torque and power. Type of load in electrical drives. Short-term operation. Intermittent operation. Intermittent operation with transient regime influence. Continous operation with intermittent load. Continous operation with the transient regime influence. Selection of the electrical motor and impact of the environment on its selection. Protection of high power industrial drives.
Methodology of teaching: Lectures, discussions and seminar labours (30 hours of lecturers, 30 hours of numeric exercises).
Appraisal system: Seminar labour 30%, presence in lectures and exercises 10% and the final exam 60%.
Basic literature:

1. Agron Orana, “Ngasje Elektromotorike”, ligjërata dhe ushtrime, Prishtinë 1995
2. B. Jurkovic, “Elektromorni Pogoni”, Zagreb 1990
3. J. Teta, “Transmisione Elektrike”, Tiranë 1990

4. M. Rashid, “Power Electronics, circuits, devices and applications”, prentice-Hall International, Inc 1995.

Course title: Master Thesis (Mandatory, Sem. IV, 30 ECTS)
The goal: Master thesis is the final scientific work that will prove the student capability to work on a scientific topic independently by using methodologically sound approaches.
Learning outcomes: At the end of this course, students will be capable to: 1. Read and understand state-of-the-art literature. 2. Independently specify, analyze and propose solutions. 3. Explain and discuss critically results. 4. Present and defend the thesis in a written and oral form.
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. 1. Reading of the state of the art. 2. Understanding and specifying the problem. 3. Design and implement different solutions. 4. Analyze and discuss critically the results.
Methods of teaching:
Compliant with the actual regulation at the faculty level on how to conduct a master thesis.
Literature:
1. Jean-Luc LeBrun. Scientific Writing. World Scientific, 2007.
2. Depending on the topic covered in thesis, different bibliographic resources will be recommended by the teachers.