Study Plan Master of Science in Electrical and Computer Engineering

Year I		
Fall Semester		**9 Credits**
Code	**Course Title**	**Credit Hours**
Code	Program Core I	3
Code	Program Core II	3
Code	Program Core III	3
Spring Semester		**9 Credits**
Code	**Course Title**	**Credit Hours**
Code	Program Core IV	3
Code	Elective I	3
Code	Elective II	3

Year II		
Fall Semester		**9 Credits**
Code	**Course Title**	**Credit Hours**
Code	Elective III	3
Code	Elective IV	3
Code	Master Thesis Phase I (Thesis Option)	3
Code	Elective IV (Project Option)	3
Code	Research Project I (Project Option)	3
Spring Semester		**3 Credits**
Code	**Course Title**	**Credit Hours**
Code	Seminar (EEPS)	0
Code	Master Thesis Phase II (Thesis Option)	3
Code	Research Project II (Project Option)	3

Courses Description

EECE 601 Advanced Engineering Management (3 credit)

Course is oriented for engineers or graduates who want to become technical specialists or managers in industrial and manufacturing companies. It increases career potential by improving knowledge and experience in engineering, technical and problem solving skills, management skills, ability to take on greater responsibility This course helps understand concepts and theories behind developing, manufacturing and managing engineering products and systems. This course provides learning to explore and apply developments in engineering and management academic thinking and industrial practice. Study involves two managements, two technical and four optional modules. Wide range of optional modules including lean operations and six sigmas, advanced manufacturing technology, applicable artificial intelligence, computer-aided design/computer-aided manufacture, advanced computer system architecture, Network applications.

The international product development module involves working in multidisciplinary teams to develop a new product in a global market. This allows student to develop much sought after advanced technical and business skills and improves student's career prospects in engineering industry, and public service. Undertaking such a project also develops particular interest in a supported environment.

EECE 602 Advanced Engineering Probability & Statistics (3 credits)

This module aims to provide statistical analysis and experimentation techniques for engineers. Topics include analysis of variance, regression analysis, factorial and fractional factorial designs, response surface methodology and non-parametric methods. The module is application oriented and examples drawn from industrial applications

rather than mathematical development will be used wherever possible to introduce a topic. Besides evening lectures on the above topic, seminars on fundamental aspects of the subject matters will be conducted. Research papers will be reviewed during the seminars.

EECE 603 Advanced Engineering Mathematics (3 credits)

Survey of advanced mathematics topics needed in the study of engineering. Topics include review of complex numbers, multivariate calculus and analytic geometry. Study of polar, cylindrical, and spherical coordinates, vector differential calculus, vector integral calculus, and vector integral theorems. Examples are provided from electromagnetic, fluid mechanics, physics and geometry.

EECE 604 Digital Signal Processing (3 credits)

Discrete-time signals and systems, frequency response, group delay, z-transform, convolution, discrete Fourier transform (DFT), fast Fourier transform (FFT) algorithms, discrete Cosine transform (DCT), discrete Sine transform (DST), relationship between DFT, DCT, and DST; design of FIR and IIR filters, finite word length effects, Hilbert transform, Hilbert transform relations for causal signals, Introduction to DSP architecture - Harvard architecture - Dedicated MAC unit - Multiple ALUs, Advanced addressing modes, Pipelining, Overview of instruction set of any typical digital signal processor..

EECE 605 Linear Systems Theory (3 credits)

Linear Algebra: Matrices- Determinants- System of Linear Equations- Eigenvalues and Eigenvectors - Diagonalization- Orthogonal and Symmetric Matrices. Some Engineering Applications.
Complex Analysis: Complex Numbers - Complex Variables -Differentiation of Complex Functions - Complex Integration -Singularities and the Residue Theorem and Some Applications of the Residue Theorem - Conformal Mappings. Implementing certain mathematical manipulations using a suitable software package (e.g. MATLAB)

EECE 606 Advanced Modeling and Simulation (3 credits)

Introduce computer simulation technologies and techniques, provides the foundations for the student to understand computer simulation needs, and to implement and test a variety of simulation and data analysis libraries and programs. This course focuses what is needed to build simulation software environments, and not just building simulations using preexisting packages. Introduce concepts of modeling layers of society's critical infrastructure networks. Build tools to view and control simulations and their results. In this course students will be able to conduct simulation study using any software for coding your models, and interpret simulation outputs. You are expected to perform a full-cycle simulation study on a real world problem using the knowledge gained throughout the course as a project. The students are directed to practical work concerning their specific field of research in their thesis..

EECE 611 Advanced Power System Analysis (3 credits)

This course consists of theoretical and practical modules.
Theory: A course on optimal dispatch of generation, symmetrical components and unbalanced faults, transient stability
Practical: simulation and analysis of balanced and unbalanced faults. Simulation of power system for modeling and analysis of transient stability studies.

EECE 612 Electrical Machines and Drives (3 credits)

This course consists of theoretical and practical modules.
Theory: Topics covered in the course include: Characteristics of DC Motors and AC motors, Slip power recovery scheme, characteristics of synchronous motors, Classification of Electric drives, Elements of electric drives, DC drives and applications, AC drives and applications, Control techniques of electric drives.
Practical: Microprocessor based control of electric drives.

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EECE 613 Power Electronics Systems and Applications (3 credits)

This course consists of theoretical and practical modules.

Theory: A course that reviews converter topologies for AC/DC, DC/AC, and DC/DC; power supply applications; converter applications to motor drives; utility interface of distributed energy systems; static VAR systems; flexible AC transmission; high voltage DC; power quality control; active and passive harmonics compensation.

Practical: Design and implementation of simple Converters and invertors.

EECE 614 Renewable Energy Systems (3 credits)

A course that covers the principles of renewable energy, solar radiation, solar water heating, building and other thermal applications, photovoltaic generation, wind power, fuel cells and the hydrogen cycle, biomass, and institutional and economic factors..

EECE 615 High Voltage Engineering and Technology (3 credits)

Topics covered in the course include: over voltages in electrical power systems, Protection of transmission lines against over voltages. Insulation coordination, electrical breakdown in gases, liquids, solids and composite dielectrics, Gaseous breakdown - uniform field – Townsend criterion, Streamer theory- Pachen's law - Non-uniform fields – Corona discharges – Vacuum breakdown - Conduction and breakdown in pure and commercial liquids – Breakdown mechanisms in solid and composite dielectrics. Generation of high voltages and high currents,

Generation of High DC Voltages: Voltage doubler - -Cockcroft Walton, Voltage multiplier - Vande-Graff generator- Generation of high AC voltages: Tesla coil, Generation of Impulse voltage: multistage impulse generator - MARX circuit and generation of impulse current - Tripping and control of impulse generators. Measurement of high voltages and high currents, Measurement of High DC voltages- AC voltages: power frequency, high frequency and impulse - High DC currents- AC currents: power frequency, high frequency and impulse- PD Measurements – Digital Storage Oscilloscope for impulse voltage and current measurements. High voltage testing of electrical apparatus, Terminologies and Definitions - High voltage testing of electrical power apparatus as per standards.

EECE 616 Distributed Generation (3 credits)

Topics covered in the course include Introduction. Definitions and terminology. Present state and development trends. Technologies: hydro power plants, biomass, wind turbines, photovoltaic generation. Technologies: cogeneration, reciprocating engines, steam and gas turbines, fuel cells. Connection of distributed generation into the network. Control of power production and voltage. Island operation. Energy flow measurements. Tariffs. DG in EU countries. Supply share of electricity and heat. Barriers and supporting mechanisms. Status of the DG in Croatia. Legal aspects. Technologies. Economic issues. Social perception. Potential and development perspectives of the DG in Croatia. Subventions. Credits. Purchase obligation. Barriers to DG in Croatia: institutional, market, technological, financial, technical. DG in various scenarios of Croatian power system development. Optimal configuration of the DG. Static and dynamic operational characteristics. DG perspectives in Croatia. Multicriterial analyses of sustainability.

EECE 617 Smart Grid Systems (3 credits)

Topics covered in the course include introduction to smart grid, Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAr control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).Introduction to Smart Meters, ethical issues in smart metering: Privacy issues. Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection. Power quality management in smart grid, Power Quality Audit, and high performance computing application for smart grid applications.

EECE 621 Transmission and Distributions (3 credits)

Energy Consumptions, Structure of power system, Parameters of resistance, inductance and capacitance calculations, single and three phase transmission lines, Phasor diagram, Classification of transmission lines,

Transmission line parameters such as Corona, skin effect, sag and interference, Compensation of reactive power, Classification of insulators and cables, Major components of sub stations, AC and DC transmission and distribution.

EECE 622 Energy Planning and Policy (3 credits)

This is a course that focuses on features of modern energy planning and policy. Topics covered include the interaction among the technological, economic, environmental, and sociopolitical aspects of energy supply and use; electricity, oil, and gas industries, and their market structures; elements of energy planning on the sector and national levels; energy decision making under conditions of uncertainty, risk management in energy planning; liberalization of energy markets; case studies.

EECE 623 Power System Planning (3 credits)

The course investigates electric energy and peak demand forecasts using weather sensitive, time curve, autoregressive and causal models; generation reliability evaluation, loss of energy expectation, energy limited units, probabilistic production costing, generating capacity expansion analysis, and maintenance scheduling; operational planning, unit commitment, hydrothermal coordination; power system security classification, contingency analysis, external equivalents, optimal power flow; planning in a competitive electric power environment.

EECE 624 Electric Power Systems Stability and Control (3 credits)

This course consists of theoretical and practical modules.

Theory: A course on synchronous machine modeling and simulation, response to small disturbances, and voltage instability. Topics include Park's transformation, flux linkage, voltage, and state space equations, sub transient and transient parameters, simplified models of the synchronous machine, and treatment of saturation, system reference frame, small-signal stability, and power system stabilizers.

Practical: Design, simulation and analysis of power system stabilizers.

EECE 625 Energy Efficiency in the Power Sector (3 credits)

Topics covered in the course include: utility companies and energy supply, energy sustainability, cogeneration systems: combined heat and power (CHP) and combined cycle gas turbines (CCGT), reciprocating engines, distributed generation, demand side management, wastage of energy, energy audit: types and data analysis, monitoring and targeting of energy, energy-efficient rotating machines, design and performance optimization; and case studies.

EECE 626 Protection of Power system and Devices (3 credits)

Topics covered in the course include: Relays and circuit breakers; Protection of generators; sequence filters; reverse, under frequency, loss of excitation; Rotor earth fault, pole slipping, protection of Turbine; Protection of Transformer; generalized differential protection, Protection due to switching; BUS and substation protection; distance rely, characteristics and critical applications; power swing conditions; Static relays; current, voltage and impedance relays, A standard relaying ; Computer and microprocessor application in protection schemes; Numerical relays.

EECE 627 Environmental Aspects of Energy Systems (3 credits)

A course that examines world energy resources and classifications; sources and effects of air pollution; air quality modeling, Gaussian dispersion models for pollution estimation; motor vehicle emissions and noise pollution; environmental impacts of electricity generation, pollution control systems, electromagnetic radiation, production and impacts in high-voltage applications; environmental impact assessment; basic concepts.

EECE 628 Solar and Photovoltaic Power Systems (3 credits)

Topics covered in the course include: Solar photovoltaic energy conversion and Principles, Physics and operation of solar cells, Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, and effect of variation of solar irradiation and temperature, losses, control algorithms. MPPT algorithm, PV tracking options. Design of Solar PV power system.

EECE 630 Special Topics in Electrical Engineering (3 credits)

This course will cover some topics suggested and conducted by a faculty member with required prerequisites. Topics include: Generation Operation and Control, High Voltage DC Transmission Systems and Flexible AC Transmission Systems (FACTS).