MATHEMATICAL MODELING OF ELECTRONIC ENGINEERING SYSTEMS

Course Code: SEIA 101
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Prof. Daniel Breaz, PhD
Laboratory tutor: Assis. Ioan-Lucian Popa, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	7

COURSE AIMS:
Using methods of modeling, simulation, identification and analysis processes, computer aided design techniques. Application development and implementation of algorithms and management structures automatic electronic systems modeling.
Work with mathematical fundamentals, engineering:
- use of theories to explain the structures and specific tools and mainframe systems
- theoretical substantiation features designed systems

ENTRY REQUIREMENTS:-

COURSE CONTENTS:
1. Elements of applied mathematics in systems theory. Basic elements of operational calculation, Fourier transformation.
2. Systems Theory and Automatic Control
3. Systems of linear time invariant smooth with an input and an output. Representation of a linear system. Representation by differential equations
4. Mathematical modeling. Transfer functions
5. Analysis of linear systems. Stationary errors. Systems of higher order than 2
6. Stability of continuous linear systems
7. Stability in frequency domain.
8. Sampling Systems
9. Numerical control systems

TEACHING METHODS:
Lecture, discussion, exemplification.

LEARNING OUTCOMES:
In order to obtain credits for this discipline, the students have to:
- Use applications fundamental concepts of analysis and synthesis of linear systems
- Use some methods of designing control systems
- development of software

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Final evaluation – 50%; Laboratory activities – 50%.

RECOMMENDED READING:

- Ke Chen, P. Giblin, A. Irving – Mathematical Explorations with MATLAB, Cambridge University Press, 1999.
- D. Arnold, J.C. Polking – Ordinary Differential Equations using MATLAB, MathWorks, 2009.
- Dragomir, T.L., Elemente de teoria sistemelor, vol I, Timişoara, Ed. Politehnica, 2004.
- Dorf, R.C., Bishop, R.H., Modern Control Systems, Pearson – Prentice Hall, Tenth Ed.,2005
- K. Ogata, Modern Control Engineering, Prentice Hall, 1990.

ELECTRONIC MICRODRIVES
Course Code: SEIA 105_1
Type of course: optional
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Adrian Tulbure, Prof.PhD
Seminar tutor: Adrian Tulbure, Prof.PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	6

COURSE AIMS:
- Objectives of the course refers to the technical knowledge concerning the configuring, commissioning and operation of modern drive systems with small and medium power.
- The course focuses especially on the adjustable drives from the technological side in a modern plant.

ENTRY REQUIREMENTS:
Programming the numerical automatic systems and integrated electronic systems

COURSE CONTENTS:
- I. Advanced drive systems - 4:00h (structures and concepts, Technical data, information and energy, Control loops).
- II. Electric micromotors - 4:00h (Electrical DC and AC single phase Machines; Brushed and brushless Motors; Hydraulic and pneumatic actuators)
- III. Structure of advanced drive - 4h (Components of the control scheme; Components of signaling and protection scheme, Components of the power scheme; Diagnosis and repair of critical driving system)
- IV. Common types of engines -4h (synchronous and asynchronous Motors; Linear motors and high torque motors; Compact high speed asynchronous / synchronous engines; Integrated brushless motors and gears)
- V. Compact Electrical Drives– 4h (Technical and functional characteristics; Environment configuration and design; Aspects of safety and reliability in operation)
- VI. Programming environment of flexible electrical drives - 4h (IndraWork - tool for design, programming and commissioning; Interfaces for the development of other industrial applications)
- VII. Industry specific standard concerning the modern drives – 4h (Flexible interface Open Core; Modern drive testing; Specific technical prescriptions)

TEACHING METHODS:
Technical presentation and meeting with experimental exemplification.

LEARNING OUTCOMES:
- understand electrical drives issues in international terminology;
- know advanced topologies for linear and rotary drive;
- know the modern concepts for modeling and simulation;
- configure and debug advanced electric smart drive.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
theoretical – 60%; experimental – 40%.

RECOMMENDED READING:

- L. Ciobanu *Tratat de inginerie electrica. Sisteme de actionari electrice.*Ed.Matrixrom ISBN:978-973-755-306-5
- C. Ghita *Masini electrice*. Ed.Matrixrom 2012.
- Ghe. Andronescu *Comenzi numerice in actionari electrice* EdMatrixRom Buc. 2015
- C. Ilas, V. *Bostan Utilizarea procesoarelor DSP in comanda numerica a motoarelor asincrone* Ed.MatrixRom Buc. 2015
- R. Beloiu *Actionari electrice cu logica cablata. Pornirea motoarelor asincrone trifazate,* Bucuresti 2015
- http://www.tme.eu/ro/pages/News:module-si-microactionari-pentru-construirea-robotilor-in-oferta-tme.html
- Ion Boldea, Syed A. Nasar *Electric Drives,* Second Edition, CRC Press 2005
- http://www.abb.de/product/ge/9AAC124838.aspx?country=DE
- *** - www.semikron.com, *** www.festo.com ***, *** www.irf.com***

POWER ELECTRONIC MODULES
Course Code: SEIA 105_2
Type of course: optional
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Adrian Tulbure, Prof.PhD
Seminar tutor: Adrian Tulbure, Prof.PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	6

COURSE AIMS:
Objectives of the course refers to the technical knowledge on the interface between power grid and electrical motor. These circuits are part of modern small and smart electric drive systems.
The course focuses on the operating power circuits from the technological chain in a modern plant.

ENTRY REQUIREMENTS:
Embedded programming and power electronics

COURSE CONTENTS:
- I. Modern systems for electricity conversion (Structures and concepts of the converters, Technical characteristics of power modules, Energy consumption, Application areas)
- II. Power modules from open loop ac-ac converters (Power and control dedicated circuits, Open loop power converter architecture, The u / f operating mode, Design aspects, Selection and commissioning)
- III. Power modules from closed loop ac-ac converters (Power and control circuits, Closed loop power converter architecture, The SVC (sensorless) and FIRE (sensor) operating mode, Design aspects, Selection and commissioning)
- IV. Power modules from dc-ac converters (Inverters architecture, Operation and programming procedure, Design aspects, Selection and commissioning)
- V. Intelligent power modules IPM (Technical and functional characteristics, Configuration and design environment; Safety and reliability in operation)
- VI. Accessories for power converters (Control panels, Connections and communication ports, Active and passive filters, Braking and dispersal resistors)
- VII. Programming environments of converters (IndraWork Platform Engineering, IndraWork Operation Platform, Open core flexible interface, Industrial Standards specific to modern electrical drives.

TEACHING METHODS:
Technical presentation and experimental meeting.

LEARNING OUTCOMES:
- Understand international terminology in the field of power electronics;
- Know relevant power electronics and control topologies for industrial use,
- Know the modern concepts of modeling-simulation with self-developed or imported models.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Theoretical – 60%; experimental – 40%.

RECOMMENDED READING:

- *** - www.polulu.com, *** www.festo.com ***, *** www.irf.com***
- Palaghiţă N., Petreuş D., Fărcaş C., Electronică de putere partea a II-a, Circuite electronice de putere,
- Editura Mediamira, Cluj-Napoca, 2004, 310 pag., ISBN 973-713-039-1
- Alexa D., Hrubaru O., Aplicaţii ale convertoarelor statice de putere, Editura Tehnică, Bucureşti, 1989.
- Mohan N., Undeland T., M., Robbins W., P., Power Electronics – Converters, Applications and Design,
- (New York: Wiley), 1995.
- Rashid M., Power Electronics: Circuits, devices and Applications, Second Edition, Prentice Hall, USA.

TECHNICAL REQUIREMENTS AND STANDARDS FOR INDUSTRIAL UNS

Course Code: SEIA 205
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Adrian Tulbure, Prof.PhD
Seminar tutor: Manuela Kadar, Assoc.Prof.PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	6

COURSE AIMS:

- The course begins with synthesize, presentation and description of specific rules and standards for industrial companies.
- Documents presented focuses primarily on computerization and automation of the production technologies.
- The second goal is to integrate intelligent plant, characterized by adaptability, efficiency and enhanced ergonomics, into the adding value process and business development.

ENTRY REQUIREMENTS:

Technical drawing and advanced diagnostic and control systems

COURSE CONTENTS:

- I.The stages of industrial development (industrial revolution, modern factory fractal / virtual, integration of suppliers, staff and beneficiary in the future plant)
- II. Industry 4.0 concept (Industry 4.0 Structure and elements - as components of Smart Factory (SF)
- III. Industry 4.0 Structure and features (modern human-machine interfaces, physical system-component base networks, Identification and repair of critical manufacturing system)
- IV. SR EN ISO 50001: 2011 audit procedure (Particular requirements and overall system power management, Energy Policy and Planning (analysis, reference level, absolute and specific indicators of energy performance, energy targets, Action plans of efficient energy management)
- V. Implementation and operation ISO 50001 (Communication, control and documentation of energy-intensive processes, Design, monitoring and evaluation of compliance with legal requirements, Conformities, corrective and preventive action)
- VI. Standard CISPR 25 (special radio disturbance) in modern plants (Experimental methods and statistical procedures for assessment the electromagnetic radiation in closed blocks, perturbations generated by industrial environments: energy distribution networks, computer networks, production flows, heat engines)
- VII. Electromagnetic compatibility systems (ITC wired installations, Compatibility of fixed and mobile installations, Classical and specific measurement procedures)
- VIII. ISO / TS 16949 automotive industry specific (Certification System IATF (International Automotive Task Force) Management of the production chain, Product manufacturing, testing, analysis and process improvement measures)
- IX. ISO 11354-1: 2011, specific advanced automation technologies and applications - requirements to achieve interoperability at all levels undertaking structural and ISO 14258: 1998 Industrial Automation Systems
- X. Energy audit and IT in the Data Center. Standards: -942 TIA, ISO / IEC 24 764, EN 50173-5 EN 50600 series.
- XI. Reassessment topics discussed themes and setting. Clarification of critical points. Future developments of standardization.

TEACHING METHODS:

Technical presentation and meeting with experimental exemplification.

LEARNING OUTCOMES:

- Knowledge of the used techniques in internal and external technical audits
- Understanding the connection between market and enterprise models
- Knowledge of the principles of efficiency and flexible production process

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

theoretical – 60%; experimental – 40%.

RECOMMENDED READING:

- Sisteme de management al energiei. Cerinte si ghid de utilizare. Energy management systems - Requirements with guidance EN 50001/2011
- ISO/TS 16949:2009 Qualitätsmanagementsysteme. Besondere Anforderungen bei Anwendung von ISO 9001:2008 für die Serien- und Ersatzteilproduktion in der Automobilindustrie; VDA, dritte Ausgabe 2009
- Matt Flowerday, A practical review of data center standards and an exploration of auditing and certification, https://www.bicsi.org.
- ISO 11354-1:2011 Advanced automation technologies and their applications -- Requirements for establishing manufacturing enterprise process interoperability
- http: www.iso.org/iso/catalogue_detail.htm?csnumber=50417