UNIVERSITATEA "POLITEHNICA"
DIN TIMISOARA
FACULTATEA DE ELECTRONICA
SI TELECOMUNICATII

PLAN DE ÎNVĂŢĂMÂNT ŞI PROGRAME ANALITICE

Pentru domeniul:
INGINERIE ELECTRONICĂ ŞI TELECOMUNICAŢII

Master

Anul universitar 2015 - 2016

ADVANCED ELECTRONICS IN INTELLIGENT SYSTEMS

CURRICULUM
Major: Electronics and Telecommunications – Master Studies in English

Nr crt	Disciplina	C	S	L	P	Cr/Ex*
Ist Year, 1st Semester						
1	Optimisation of Energy Converter Parameters	2	0	2	0	8/E
2	Artificial Intelligence	2	0	1	1	8/E
3	Metrology and Quality Control	2	0	1	0	7/E
4	Elective 1	2	0	1	0	7/D
	Total	**8**	**0**	**5**	**1**	**30**
Ist Year, 2nd Semester						
1	Intelligent Drive Control	2	0	1	0	7/E
2	Soft-Switching Techniques	2	0	1	1	8/E
3	Graphical Programming	2	0	1	1	8/E
4	Elective 2	2	0	0	1	7/D
	Total	**8**	**0**	**3**	**3**	**30**
IInd Year, 3rd Semester						
1	Systems on Chip Design	2	0	1	1	8/E
2	Industrial Control Technology	2	0	1	1	8/E
3	Elective 3	2	0	0	1	7/E
4	Elective 4	2	0	0	1	7/D
	Total	**8**	**0**	**2**	**4**	**30**
IInd Year, 4th Semester						
1	Practical Training/Research					15/D
2	Master Thesis Elaboration					15/E
	Total					**30**

Elective 1	Modern Programming Techniques PCBA Design and Manufacturing Mathematical Morphology
Elective 2	Real-Time Systems ASIC Design Pattern Recognition
Elective 3	Low Power Systems Flexible and Adaptive Systems
Elective 4	Advanced Multimedia Technologies Spectral Analysis and Estimation

Legend

C	S	L	P	Cr/Ex*
Course	Seminar	Laboratory	Project	Credits/Examination form

* Evaluation form: E = exam; D = distributed evaluation

OPTIMISATION OF ENERGY CONVERTERS PARAMETERS

A. COURSE OBJECTIVES

The course has as main objective to describe different topologies of the best energy converters active filters and uninterruptible power supplies, their applications, configurations, control methods, modeling and analysis, and stability issues. Reducing the number of switches allows one of the most significant cost reduction of the converters.

B. COURSE TOPICS

1. Classification of the power converters(3 hours)
2. Power supplies with power d.c. - d.c. converters(3 hours)
3. Harmonic sources in electrical systems; effect of harmonics; harmonic mitigation methods. (2 hours)
4. Control strategies for power converters (3 hours)
5. Reduced-parts uninterruptible power supplies (3 hours)
6. New on line uninterruptible power supplies systems based on novel a.c. - d.c rectifiers.(3 hours)
7. New single – phase to three-phase hybrid line interactive/on –line uninterruptible systems(3 hours)
8. Batteries for uninterruptible power supplies applications(3 hours)
9. Modeling, analysis and digital control(3 hours)
10. Implementation of active filters. (2 hours)

C. APPLICATIONS TOPICS

The students will be grouped in teams (3-4 members) and each team will perform laboratory work according to course topics above. A small project will be also elaborated. The projects will be presented at the end of the course in a special project session.

D. REFERENCES

1. V. POPESCU, „Electronică de putere”, Ed. de vest, Timişoara, 2005.
2. V. POPESCU, D. LASCU, D. NEGOIȚESCU, “Convertoare de putere în comutaţie”, Ed. De Vest, Timişoara, 1999.
3. V. POPESCU, “Surse de alimentare neîntreruptibile”, Ed. De Vest , Timişoara, 2004.

ARTIFICIAL INTELLIGENCE

A. COURSE OBJECTIVES

Introduction in the field of Neural Networks, Evolutionary Computing, Fuzzy Systems as part of a broader area, Computational Intelligence, constituted the primary objective of the course. Among topics emphasized are: the most important neural networks architectures along with functioning algorithms, the intelligent hybrid systems, e.g. neuro-fuzzy and neuro-genetic systems, and the applications of the neural networks in different areas, e.g. robotics, signal and image processing, etc.

B. COURSE TOPICS

1. Introduction. Artificial neural networks (ANN) – definitions and proprieties, Biologic neuron, Artificial neuron, ANN architectures, training types and learning algorithms (2h).

2. Perceptron type artificial neural network. Simple perceptron, Adaline ANN and the LMS algorithm, Multilayer Perceptron, Fast training algorithms (2h).
3. Radial Basis Neural Networks. The interpolation problem, learning strategies for RBF networks (2h).
4. Recurrent Neural Networks. Hopfield, Jordan and Elman neural networks architectures and training algorithms (2h).
5. Self-organising Neural Networks. Self-organising feature map and competitive learning, LVQ (2h).
6. Intelligent Hybrid Systems (8h).
- Genetic Algorithms, Evolution Strategies, Evolutionary Programming, Neuro-genetic systems.
- Fuzzy Logic, Neuro-fuzzy systems.
- Reinforcement Learning, temporal difference based neural networks.
7. Computational Intelligence Implementations (4h).
8. Artificial Intelligence Applications (6h).

C. APPLICATIONS TOPICS

LABORATORY

1. A brief introduction in MATLAB.
2. Models of the neurons and artificial neural networks.
3. Simple perceptron. LMS algorithm.
4. Multilayer perceptron. Backpropagation algorithm.
5. Fast training algorithms for feedforward neural networks.
6. User graphical interface design for a neural network application using MATLAB.
7. Radial Basis Neural Network implementation.
8. Recurrent Neural Network implementation.
9. Self-organising Neural Network implementation.
10. Cellular Neural Network implementation.
11. Hybrid neuro-fuzzy systems.
12. Hybrid neuro-genetic systems.
13. Local search and optimization.

PROJECT

The project will imply Matlab implementation of various applications of the artificial intelligence in the field of applied electronics .

D. REFERENCES

1. S. J. Russell, P. Norvig, "Artificial Intelligence. A Modern Approach", Second Edition, Prentice Hall, 2003.
2. V.Tiponuţ, C.D. Căleanu, "Neural Networks. Architecturea and Algorithms", Ed. Politehnica, Timişoara, 2001.
3. C.D. Căleanu, V. Tiponuţ, "Neural Networks. Applications", Ed. Politehnica, Timişoara, 2002.

METROLOGY AND QUALITY CONTROL

A. COURSE OBJECTIVES

The course introduces the student to all the main aspects of the discipline providing a strong broad base of knowledge and a thorough understanding of the basic principles and methodology of the discipline as well as a range of intellectual skills

that develop as fully as possible the complete range of mental abilities, i.e. the enlargement and proficiency of mind that has long been a fundamental goal of university education.

B. COURSE TOPICS

1. The measurement process. Specific measurement methods (6 h)
2. Standars and calibration (8 h)
3. Legal metrology (4 h)
4. Standards and standardization (4 h)
5. Quality control (6 h)

C. APPLICATIONS TOPICS

1. Calibration of a digital voltmeter
2. Ellaboration of the technical documentation for a measuring instrument

D. REFERENCES

1. J. M. Juran ş.a. – Calitatea produselor, Ed. Tehnică, Bucureşti, 1973
2. D. Stoiciu – Metrologie, calitate şi fiabilitate, Lito. UTT, Timişoara, 1995
3. J. S. Oakland – Statistical Process Control, Butterworth-Heinemann, Oxford, Fifth edition, 2003

MODERN PROGRAMMING TECHNIQUES

A. COURSE OBJECTIVES

The course provides a broad, solid understanding of essential Visual Basic topics. It describes the Visual Basic language itself and explains how to use it to perform a host of important development tasks. It also explains the forms, controls, and other objects that Visual Basic provides for building applications in a modern windowing environment. It does cover the majority of the technologies that developers need to build sophisticated applications.

B. COURSE TOPICS

1. Introducing .NET. The .NET Framework The Visual Basic Language. Types, Objects, and Namespaces.

2. Developing ASP.NET Applications. Visual Studio. Web Form Fundamentals. Web State Management. Error Handling, Logging, and Tracing. Deploying ASP.NET Applications

3. Data Types, Variables, and Constants. Operators

4. Subroutines and Functions. Inheritance Mode. Property Procedures. Extension Methods. Lambda Functions. Relaxed Delegates. Partial Methods

5. Program Control Statements. Decision Statements. Single Line If Then. Multiline If Then. Select Case. Enumerated Values. IIf. If. Choose. Looping Statements. For Next. Non-integer For Next Loops. For Each. Exit and Continue

6. Building Better Web Forms. Validation Rich Controls. User Controls and Graphics. Styles, Themes, and Master Pages. Website Navigation

7. Working with Data. ADO.NET Fundamentals. Data Binding. The Data Controls. Files and Streams.XML

C. APPLICATIONS TOPICS

1. Introduction to the IDE. Menus, Toolbars and Windows.
2. Visual Basic Code Editor. Debugging.

3. Selecting Windows Forms Controls. Using Windows Forms Controls. Windows Forms
4. Selecting WPF Controls . Using WPF Controls .WPF Windows
5. Database Controls and Objects
6. OOP Concepts. Classes and Structures. Namespaces. Collection Classes. Generics.
7. Graphics. Drawing Basics. Brushes, Pens, and Paths. Text. Image Processing. Printing. Reporting.
8. Interacting with the Environment. Configuration and Resources. Streams. File-System Objects. Windows Communication Foundation. Useful Namespaces.

D. REFERENCES

1. MacDonald Matthew, Beginning ASP.NET 3.5 in VB 2008, Apress, Springer Verlag, 2007.
2. Stephens Rod, Visual Basic® 2008. Programmer's Reference, Wiley Publishing, 2008.

PCBA DESIGN AND MANUFACTURING

A. COURSE OBJECTIVES

- To provide advanced knowledge and skills about all relevant aspects regarding the design, development and manufacturing of complex printed circuit board assemblies
- To provide basic knowledge about signal integrity and thermal management of electronic modules
- To introduce modeling and simulation techniques for virtual prototyping of printed circuit board assemblies

B. COURSE TOPICS

- An overview of electronic technologies
- Advanced packaging of electronic devices
- Printed circuit board manufacturing technologies
- Module assembly technologies
- Computer aided manufacturing
- Intelligent design of PCBA (aka: Design for Excellence)
- Signal integrity issues in PCB design
- Virtual prototyping for signal integrity
- Thermal management of electronic modules
- Virtual prototyping for thermal management

C. APPLICATIONS TOPICS

- Printed circuit board manufacturing technologies
- Computer aided manufacturing of PCBA
- Expert systems for intelligent design
- Electrical modeling of printed circuit boards
- Signal integrity analysis of printed circuit boards
- Power integrity analysis of printed circuit boards
- Thermal analysis of electronic modules

D. REFERENCES

1. Clyde F. COOMBS (ed.) Printed Circuits Handbook, McGraw Hill, 2001.

2. Glenn BLACKWELL (ed.), The Electronick Packaging Handbook CRC Press, 2000.
3. Joseph FJELSTAD, Flexible Circuit Technology, BR Publishing, 2006.
4. Happy HALDEN, The HDI Handbook, BR Publishing, 2009.
5. Rudolf STRAUSS, SMT Soldering Handbook, Newnes, 2008.
6. Ralph REMSBURG, Thermal Design of Electronic Equipment, CRC Press, 2001.
7. Stephen THIERAUF, High Speed Circuit Board Signal Integrity, Artech House, 2006.
8. Brian YOUNG, Digital Signal Integrity: Modeling and Simulation with Interconnects and Packages, Prentice Hall, 2001.

MATHEMATICAL MORPHOLOGY

A. COURSE OBJECTIVES

The course provides advanced theoretical foundations of mathematical morphology, a powerful framework for the analysis and processing of geometrical structures. Its main applications are signal processing, particularly image processing. Students following this course will acquire the ability to derive properties of morphological operators, as well as the modelling skills needed in finding morphology based solutions to engineering problems.

B. COURSE TOPICS

Basic structures and operations
Properties of morphological operations
Derived morphological operators
Morphological filters
Morphological segmentation
Shape analysis using mathematical morphology

C. APPLICATIONS TOPICS

Dilation and erosion
Opening and closing transforms
Grey scale morphological filtering
Skeletons and thinning
Morphological gradients
Watershed segmentation
Shape analysis using mathematical morphology

D. REFERENCES

1. *Morphological Image Analysis; Principles and Applications* by Pierre Soille, ISBN 3540-65671-5 (1999), 2nd edition (2003)
2. *An Introduction to Morphological Image Processing* by Edward R. Dougherty, ISBN 0-8194-0845-X (1992)
3. Jean. Sera, "Mathematical Morphology Online Courses", http://cmm.ensmp.fr/~serra/cours/index.htm

INTELLIGENT DRIVE CONTROL

A. COURSE OBJECTIVES

The course has as main objective to supply the theoretical and methodological support for analyze, design, testing and implementation of the INTELLIGENT DRIVE CONTROL systems, executives and applications. For these purposes, a structured development approach for intelligent drive control systems is introduced as concrete real-time applications.

B. COURSE TOPICS

1. Space-time correlation in trajectory explain.(2 hours)
2. Movement lows(2hours)
3. DC motor electrical digital drives. (4 hours)
4. Real time issues (2 hours)
5. Speed control digital electrical drives(2 hours)
6. Speed and position electrical digital drives. (3 hours)
7. Modelling. Digital control algorithms design. (4 hours)
8. AC motor electrical digital drives. (3 hours)
9. Brushless DC motor electrical digital drives. (3 hours)
10. DSP applications in intelligent drive control.(2 hours)

C. APPLICATIONS TOPICS

The students will be grouped in teams (3-4 members) and each team will perform laboratorz work and elaborate a project based on course topics. The projects will be presented at the end of the course in a special project session.

D. REFERENCES

1. Bogdanov, I, *Conducerea cu calculatorul a acţionărilor electrice*, Ed.”Orizonturi universitare”, Timişoara, 2004, ISBN : 973 – 638 – 112 – 9.
2. Bogdanov, I, *Microprocesorul în comanda acţionărilor electrice*, Ed. „Facla”, Timişoara, 1989, ISBN : 973 – 36 – 0030 –X.
3. Kenjo, T., *Power Electronics for the microprocessor age*, Oxford University Press, 1995, ISBN : 0198565089.

SOFT-SWITCHING TECHNIQUES

A. COURSE OBJECTIVES

The main objective of the course is to define, to rigorously present and treat in sufficient depth the soft-switching mechanisms in power electronics converters so that the students acquire the knowledge and skills needed to design practical high-frequency soft-switching architectures.

B. COURSE TOPICS

1. Soft-Switching Mechanisms of Power Semiconductor Devices. Normalization, State-Plane Analysis and Other Analytical Tools (2 hours).
2. Quasi-Resonant Converters. Zero-Current and Zero-Voltage Switching. Full-Wave and Half-Wave Modes. The Multi-Resonant Switch Cell (3 hours)
3. Quasi-Square Wave Resonant Switches. Single Transistor and Synchronous Rectifier Topologies (3 hours)
4. Soft-Switching in PWM Converters. The Zero-Voltage Transition and Active Clamp Converters. The Auxiliary Switch Approach. Auxiliary Resonant Commutated Pole (3 hours)

5. Sinusoidal Analysis and Design Methods for Resonant Converters (3 hours)
6. The Series Resonant Converter: Analysis, Subharmonic modes (3 hours)
7. Parallel Resonant DC-DC Converter. Computer Analysis to Evaluate Characteristics and Stresses (3 hours)
8. Load Dependent Properties of Resonant Converters. Inverter Output Characteristics. Dependence of Transistor Current on Load. ZVS and ZCS Boundary Dependence on Load (3 hours)
9. Soft-switching Converters Modeling. Extension of State-Space Averaging to Soft-Switching Switches. Small-Signal Averaged Models for Soft-Switching Cells (3 hours)
10. Controller Design for Soft-Switching Topologies (2 hours).

C. APPLICATIONS TOPICS

1. Reverse recovery of freewheeling diode in the Forward converter. Zero voltage switching in a bridge configuration.
2. Boost ZVS FW resonant converter.
3. The QSW Buck converter with synchronous rectifier.
4. Effect of magnetizing current on zero-voltage switching in the ZVT full-bridge topology.
5. Flyback Converter with active clamp snubber.
6. Dual of the series resonant converter.
7. State plane analysis of the series resonant converter above resonance.
8. The LCC resonant inverter
9. Small-signal transfer functions of the ZCS HW Flyback converter and controller design.
10. Spacecraft battery charge/discharge dc bus interfacing bidirectional converter.

D. REFERENCES

1. Ang, S., Oliva, A., "Power-Switching Converters", Second Edition, CRC Press, Taylor and Francis Group, 2005
2. Erickson, R. W., Maksimović, D., "Fundamentals of Power Electronics" (2nd edition), Kluwer Academic Publishers, 2001.
3. Mohan, N., Undeland, T., Robbins, W., "Power Electronics: Converters, Applications and Design", John Wiley & Son, 1995.

GRAPHICAL PROGRAMMING

A. COURSE OBJECTIVES

Virtual instrumentation represents a revolutionary graphical programming having the main purpose to help engineers and scientists to use data acquisition boards, to control instruments, analyse measurements and present data. Learning and using graphical programming the user can create by himself the desired instrument, implementing the front panel and as well the corresponding functionality for having a good answer to all needs. Graphical programming is used in research, complex metrology, automatisation and monitoring. The procentual contribution of this discipline is 20% respect to the specialization domain.

B. COURSE TOPICS

1.LabVIEW graphical programming introduction: virtual instrument concept;

building block diagram; virtual instruments debugging and execution; building virtual instruments and virtual subinstruments; instructions for programs execution control; programming and managing events; data cluster using strings, arrays and structures; local and global variables; wavecharts and wavegraphs; library elements for graphic and sound; files management; formula and equations; polimorphological functions; customizing virtual instruments; virtual instruments execution interactive control; using network elements. (8hours)

2.Interaction with Windows components: ActiveX Server applications, Client.(1 hour)

3.LabVIEW applications distribution: executable, virtual instruments, dynamic linked libraries. (1hour)

4.Calling code in clasical programming languages: C, C++, MatLAB.(1 hour)

5.Data acquisition: National Instruments multifunctional data acquisition board presentation; specifique virtual instruments for data acquisition.(2hours)

6.Instruments control: communication types, instrumental drivers use. **TestStand:** TestStand introduction; TestStand operating domain; secquence development; parameters, variabiles, expressions; code modules development in LabVIEW, LabWindows/CVI, VisualBasic, C/C++; ActiveX API-application programming interface use; properties import and export; TestStand configuration; users management; TestStand data types; Databases use; records configuration in databases; applications distribution; introduction in IVI (Interchangable Virtual Instruments). (4 hours)

7.LabWindows/CVI: introduction in LabWindows/CVI; building user interface (controls, panels, menu, user interface programming, graphical representations); connectivity (TCP - protocol for transmission control, DDE – dynamic data exchange, integrating DLL – dynamic linked libraries integration, network communications, internet/web); programming input-output (serial, GPIB, VISA, instrumental drivers); advanced programming techniques (creating DLL, applicationa distribution, object oriented programming, multithreating execution). (3 hours)

8. Using Signal Processing Toolbox (2hours)

9. Using Image Processing Toolbox (2hours)

C. APPLICATIONS TOPICS

Laboratory

1. Creating, editing and debugging a VI. Creating a SubVI. (2 hours)
2. Loops and charts. (2 hours)
3. Arrays and graphs. (2 hours)
4. Case and sequence structures. (2 hours)
5. Strings and file I/O. (2 hours)
6. Data acquisition. (2 hours)
7. Instrument control. (2 hours)

Project

1. Creating virtual function generator. Creating virtual oscilloscope. (2 hours)
2. Creating virtual spectral analyser. (2 hours)
3. Creating a monitoring, controlling and analysing temperature multipoint system. (2 hours)
4. Creating a developed test application using test sequences. (2 hours)

5. Creating an elaborated graphical user interface (GUI). (2hours)
6. Biomedical Signal Processing. (2hours)
7. Biomedical Image Processing. (2 hours)

D. REFERENCES

1. G Programming Reference Manual. National Instruments, January 2007.
2. www.ni.com/pdf/manuals - TestStand, National Instruments, 2005.
3. www.ni.com/pdf/manuals - LabWindows/CVI, National Instruments, 2005.
4. Kayvan Najarian, Robert Splinter, Biomedical Signal and Image Processing, CRC Press, Taylor&Francis Group, 2006.

REAL TIME SYSTEMS

A. COURSE OBJECTIVES

Introducing Real-Time Systems (RTS). Learn how to design, analyze and implement RTS. Managing resources to meet constrains. Description of real-time programming languages and operating systems. Real-time communication networks structures and principles.

B. COURSE TOPICS

1. RTS history and definitions.
2. General RTS hardware and software structure.
3. Modeling real-time systems.
4. Managing hardware resources.
5. Real time I/O interfacing.
6. Programming languages and real-time operating systems (RTOS).
7. Tasks, scheduling, resource handling.
8. Reliability and faults toleration.
9. Real-time communication and networking.
10. Time triggered CAN (TTCAN). Practical solutions.

C. APPLICATIONS TOPICS

RTS implementation based on given resources and constrains. Each project will be split in tasks for 3-4 student teams, having as deadline the end of semester.

D. REFERENCES

1. Jane W.S. Liu, *Real-Time Systems*, Prentice Hall 2000.
2. Hermann Kopetz, *Real-time systems: design principles for distributed embedded applications*, Springer, 1997
3. PA Laplante, *Real-Time Systems Design & Analysis*, Wiley India, 2006

ASIC DESIGN

A. COURSE OBJECTIVES

The course content addresses to master students in the Electronics and Telecommunications Faculty aiming to explore advanced study of digital system design – ASIC's. The aim of the course is to train students on the latest design tools technology and get a solid education to start a career in advanced electronic circuit design. The level of the course will be demanding and only dependent on the student background and capacity.

B. COURSE TOPICS

Hardware Description languages in design – advanced topics, 1 course (2 hours)

2. Digital Circuit VHDL Descriptions for Synthesis, 2 courses (4hours)
3. Hardware Acceleration Solutions for Real Time, 2 courses (4hours)
4. ARM Microprocessor Architecture, 2 courses (6 hours)
3. Internal Architecture of new FPGA series, 2 courses (4hours)
4. Digital circuit Design using ISE Core Generator and IP's, 2 courses (6 hours)
5. Direct Digital Signal Generator Architectures, 1 course (2 hours)
8. VHDL – Verilog migration, 1 course, (2 hours)
5. Analog Mixed Mode simulations using AHDL, 1 course (2 hours)

C. APPLICATIONS TOPICS

1. Simulation of VHDL descriptions – Active VHDL
2. ISE Xilinx IP digital design environment
3. Mentor Graphics IC Studio
4. ARM Architecture Experience
5. Xilinx Embedded Development Kit
6. Selected Open Cores Project
7. Migration of Designs from FPGA to ASIC

D. REFERENCES

1. I Smith Application Specific Integrate Circuits Addison Wiley 1997
2. Mentor Graphics Documentation Mentor Graphics 1990 - 2007
2. Open Cores Projects OpenCores 2006
3. Henessy , Paterson, Principles of VLSI design McGrow Hill 1993

PATTERN RECOGNITION

A. COURSE OBJECTIVES

The course addresses the main concepts in pattern recognition techniques from both theoretical and practical point of view. Our goal is to provide the knowledge needed to understand research papers and to solve practical pattern recognition applications.

B. COURSE TOPICS

Introduction
Bayesian Decision Theory
Maximum Likelihood and Bayesian Parameter Estimation
Nonparametric Techniques
Linear Discriminant Functions and Neural Networks
Feature Selection and Extraction
Machine Learning
Unsupervised Learning and Clustering

C. APPLICATIONS TOPICS

Image feature extraction
Normal BayesClassifier
K-Neares neighbour classifiers
Support Vector Machine Classifiers
Decision Trees
Boosting
Espectation Maximization
Neural Networks

D. REFERENCES

1. R.O.Duda, P.E.Hart, D.G. Stork, "Pattern Classification, 2nd Edition , Wiley 2000
2. C.M. Bishop, "Neural Networks for Pattern recognition", Oxford University Press, 2004.

SYSTEMS ON CHIP DESIGN

A. COURSE OBJECTIVES

The System-on-Chip course gives the students skills for the design of embedded systems consisting of analogue/RF, mixed mode, and digital ASICs, for system level integration on silicon. A student will know how to partition systems and be able to make a trade-off between solutions based on the different domains. To this end, all abstraction levels from system level specifications down to the circuit level and physical limitations including modeling from one domain to another are included.

B. COURSE TOPICS

1. Introduction to System-on-Chip Architectures.
2. Design Methodology for SoC Logic Cores
3. RTL Guidelines for Design Reuse
4. Verification
5. Design Validation
6. Design Examples
7. Network-on-Chip Introduction and Topologies
8. Routing Algorithms and Mechanics
9. Flow Control
10. Deadlock and Livelock
11. Quality of Service in Communication Networks

C. APPLICATIONS TOPICS

1. Embedded Systems and SoC Architectures
2. Digital Design with HDL
3. VHDL and VHDL-AMS
4. SoC Testing of Logic Cores
5. Testing of Embedded Memories
6. Testing of Analog and Mixed-Signal Circuits
7. IDDQ Testing
8. Production Testing
9. SoC – reconfigurable products
10. System Level Validation
11. Design of Fault-tolerant Systems

D. REFERENCES

1. Sudeep Pasricha; Nikil Dutt, On-Chip Communication Architectures: System on Chip Interconnect, Morgan Kaufmann (Publisher), 2008.
2. Wolf Wayne, Modern VLSI Design. System on Chip Design, Prentice Hall, 2002.
3. Rajsuman Rochit, System-on-a-Chip Design and Test, Artech House Publishers, 2000.

INDUSTRIAL CONTROL TECHNOLOGY

A. COURSE OBJECTIVES

The course is industrial technology and control systems focused, with the emphasis on system interfaces together with a range of control applications including industrial control (SCADA), intelligent control and data communications in distributed networks. It is suitable for students wishing to pursue a career in digital electronic industry.

B. COURSE TOPICS

1. **Computer Hardware for Industrial Control:** Microprocessor Unit Organization, Microprocessor Unit Interrupt Operations, Microprocessor Unit Input/Output Rationale, Programmable Peripheral Devices (4 hours)
2. **System Interfaces for Industrial Control**: ASI, Fieldbus System, PROFIBUS, Industrial Ethernet, FlexRay, Human – Machine Interface in Industrial Control, HART Field Communications, Fault tolerant systems (10 hours)
3. **Digital Controllers for Industrial Control:** Computer Numerical Control (CNC) Controllers, Supervisory Control and Data Acquisition (SCADA) Controllers, Proportional-Integration-Derivative (PID) Controllers (6 hours)
4. **Data Communications in Distributed Control System:** Distributed Industrial Control System, Data Transmission Control Circuits and Devices, Data Transmission Protocols, Data-Link Protocols, Data-Link Protocols (8 hours)

C. APPLICATIONS TOPICS

Laboratory

1. Implementing a Network Interface on TINI (3 hours)
2. Boot Loader Instruction Sets for the TINI Platform (3 hours)
3. SCADA team applications (search on Internet for SCADA devices) (3 hours)
4. Applications in Matlab and SIMULINK Real-Time Workshop (5 hours).

Project

The student will select one of the following projects:

1. Control via Ethernet.
2. Interconnecting CAN busses via Ethernet.
3. Using Simulink to construct block diagrams of control systems and simulate them.
4. Selecting the best controller for specific serial busses.

D. REFERENCES

1. Zhang, Peng, **Industrial Control Technology: A Handbook for Engineers and Researchers, ISBN-10:** 0815515715 **ISBN-13:** 9780815515715, 867 p, 2008.
2. Deon Reynders, Steve Mackay, Edwin Wright, **Practical Industrial Data Communication: Best Practice Techniques**, **ISBN-10:** 0750663952 **ISBN-13:** 9780750663953, 428 p, 2004, Butterworth-Heinemann.
3. Bailey, David; Wright, Edwin, **Practical SCADA for Industry, ISBN-10:** 0750658053 **ISBN-13:** 780750658058, 298 p, 2003, Elsevier Newnes.

LOW POWER SYSTEMS

A. COURSE OBJECTIVES

The course provides theoretical knowledge and practical skills for the optimization of electronic systems so that energy consumption should be minimized. It will present the basic techniques that provide a low power consumption.

B. COURSE TOPICS

1. Introduction in low power circuits. (1h)
2. Energy consumption in electronic circuits. (3h)
3. Power dissipation in electronic systems. (3h).
4. Devices and technologies for low power systems. (3h).
5. Design workflow for low power systems (6h)
6. Hardware techniques for power consumption optimization. (2h).
7. Software techniques for power consumption optimization. (2h)
8. The management of the dynamic energy consumption. (2h)
9. Low power microcontrollers (4h)
10. Analysis and estimation of the power consumption in electronic circuits (2h).

C. APPLICATIONS TOPICS

The project accustoms the students with specific problems concerning the design of low power circuits.

1. Software techniques to reduce dynamic energy consumption. (2h)
2. Simulation of power dissipation in CMOS circuits. (2h)
3. Low power microcontrollers. The clock signal. (2h)
4. Low power microcontrollers The characteristics of flash memory. Hardware Multiplier. (2h)
5. The control of a DC motor with a low power circuit. (3h)
6. Making a DAC with the low power PWM timers. (3h)

D. REFERENCES

1. C. Piguet, *Low-Power Electronics Design;* CRC Press; Florida, 2005
2. J.M. Rabaey, M. Pedram; *Low Power Design Methodologies*; Kluwer Academic Publishers; London, 1996
3. J. Luecke; Analog and Digital Circuits for Electronic Control Systems Applications
4. Using the TI MSP430; Elsevier, London, 2005.

FLEXIBLE AND ADAPTIVE SYSTEMS

A. COURSE OBJECTIVES

The course has as main objective to supply the theoretical and methodological support for learning, analyzing, synthesizing, modeling and testing the components and the complete FAS. For these purposes, a structured development approach for devices, components, synthesizing concepts and methods, as well as modeling techniques are detailed.

B. COURSE TOPICS

1. Systems theory overview. (2 hours)
2. Basics definitions in manufacturing systems.(2 hours)
3. FMS basic notions.(2 hours)

4. Computer integrated FAS. Use of robots.(2 hours)
5. FAS analysis (3 hours)
6. FAS synthesis. (3 hours)
7. FAS examples (4 hours)
8. FAS modeling. (6 hours)
9. Hyper FAS.(2 hours).

C. APPLICATIONS TOPICS

The students will be grouped in teams (3-4 members) and each team will elaborate a project based on course topics. The projects will be presented at the end of the course in a special project session.

D. REFERENCES

1. Kopaček, P., Einführung in CIM, TU Wien, Austria, 1993.
2. Kovacs, Fr, ş.a., Sisteme flexibile de fabricaţie, Ed."Politehnica", 2004.
3. Tavalga, J, Flexible Manufaturing systems in Practice,Addison-Wiley reading, MA,USA.
4.Gräser, A, Petri Netz, Universität Bremen, 2005.
5. Ivan Bogdanov, "Sisteme flexibile de fabricaţie", curs suport electronic, 2004

ADVANCED MULTIMEDIA TECHNOLOGIES

A. COURSE OBJECTIVES

The course objective is to provide advanced theoretical information of the scientific area, with a strong emphasize for up –to-date technology development. The course goal is to provide information, knowledge in updated technologies used in e-commerce, e-learning and e-government, on the convergence between Internet and mobile communication technologies, as well as the technical presentation of the Information Society technologies.

B. COURSE TOPICS

Tendencies regarding multimedia technologies evolution
Structure tasks and user adaptability
Advanced technologies and software for multimedia applications
Advanced Web programming
HCI (Human Computer Interaction): definition and concepts, implementation strategies
Software Engineering
Mobile multimedia technologies
Infrastructure multimedia technologies
Multimedia applications engineering
Interactive-TV, WebCast, DVB, DAB, Video On Demand
Communication media convergence
Internet security protocols

C. APPLICATIONS TOPICS

Case studies – electronic payment systems, smart-card security, e-leaning, e-voting, e-gouverment
– multimedia infrastructure applications' testing
– software testing (including CGI and API scripts)

D. REFERENCES

1. N. Chapman, J. Chapman – Digital Multimedia, Wiley, 2001
2. J. Watkinson – Convergence in Broadcast si Communications Media, Focal Press, 2001
3. F. Halsall – Multimedia Communications, Addison Wesley, 2001
4. R. S. Tannenbaum – Theoretical Foundations of Multimedia, Comp. Science Press, 1998
5. England, Elaine, Finney, Andy, *Managing Multimedia, Project Management for Interactive Media*, second edition, Addison Wesley Longman Limited, Harlow, England, 1999, ISBN 0-201-36058-6
6. Pirouz, Raymond, Weinman, Lynda, *Click Here, Web Communication Design*, New Riders Publishing, Indianapolis, USA, 1997, ISBN 1-56205-792-8

SPECTRAL ANALYSIS AND ESTIMATION

A. COURSE OBJECTIVES

Introduction of advanced topics in frequency repesentation of signals; non-parametric and parametric estimation techniques and algorithms for quantities related to the frequency representation of signals. The course is motivated by recent developments of the field and its applications in communications, measurement, speech processing, automation, imaging etc.

B. COURSE TOPICS

Introduction: Overview of the field and its applications; Random signals: power, spectral density and coherency; Cramer-Rao lower bound. **Nonparametric spectrum estimation methods:** Periodogram, corelogram, FFT, sampling, windowing, zero-padding: Bias and variance. **Parametric methods for line spectra:** Models for sinusoids in noise, nonlinear least squares method, Pisarenko method, Yule-Walker method etc. **Parametric methods for rational spectra:** AR, MA and ARMA signals; Yule-Walker method, Levinson-Durbin algorithm, Subspace parameter estimation;

C. APPLICATIONS TOPICS

The project will consist of Matlab implementation of a package of algorithms for spectral analysis:

1. FFT and periodograms
2. AR, MA and ARMA processes
3. Pisarenko method
4. The Yule-Walker method
5. The Levinson-Durbin algorithm
6. Adaptive algorithms.

D. REFERENCES

1. P. Stoica, R. Moses, *Introduction to Spectral Analysis,* Englewood Cliffs NJ:1997.
2. S.M. Kay, *Modern Spectral Estimation: Theory and Applications,* Englewood Cliffs NJ: Prentice Hall, 2000.
3. P.M.T. Broersen, *Automatic Autocorrelation and Spectral Analysis,* London: Springer, *2006*.