AUTOMATICS AND APPLIED INFORMATICS
(2018 - 2019 academic year)

1st year of study – 1st semester (autumn)

Linear algebra, analytical and differential geometry – Dorina FECHETE

1. Preliminaries (sets, relations, functions, algebraic structures, matrices, determinants, systems of linear equations)
2. Vector spaces. Properties and examples
3. Basis and dimension of a vector space
4. Change of basis of a vector space
5. Subspaces
6. Linear transformations. Definitions and properties
7. Matrix of a linear transformation
8. Eigenvalues and eigenvectors; Matrix diagonalizations
9. Bilinear forms and quadratic forms
10. Inner-products, norms and metrics
11. Euclidean vectors
12. Analytic geometry
    - Equations and curves
    - Lines and planes
    - Conic sections
    - Quadric surfaces
13. Differential geometry of curves and surfaces

Mathematical Analysis – Loredana IAMBOR

1. The real numbers: some basic concepts
2. Sequences of real numbers
3. Series of real numbers; Series with nonnegative terms (I)
4. Series with nonnegative terms (II); Alternating series
5. Limits, continuity and differentiation of real-valued functions of one real variable
6. Higher order derivatives; Taylor series and power series
7. The Riemann integral; Improper integrals
8. The Euclidean (topological) space ; Sequences of points in
9. Limits and continuity of real-valued functions of several variables
10. Partial derivatives and the differential
11. Local extremum points for real-valued functions of several variables
12. Double integrals. Triple and multiple integrals. Change of variables
13. Surface integral. Flux of vector field across a surface. Stokes' Theorem

Physics – Sanda FILIP

I. Elementary Mechanics

1.Kinematics

Simple Motion in One, Two or Three Dimensions.
Inertial and Non-Inertial Reference Frames.

2. Dynamics

Newton's Laws. Conservation of Mechanical Energy.
Generalized Work-Mechanical Energy Theorem for Systems of Particles.
Center of Mass. Collisions.

3. Gravity

Kepler's Laws. Newton's Law of Gravitation.
The Gravitational Field. Gravitational Potential Energy.

4. Oscillations

The Simple Harmonic Oscillator. Y motion. Applications of simple harmonic movement.
Damped Oscillation. Damped, driven Oscillations. Resonance.

Two Dimension Oscillations.

5. Elastic Properties of Materials - Fluids. Waves.

Static Fluids. Fluid Flow. Fluid Viscosity.

Solutions to the Wave Equation. Sound Wave in a Fluid.

II. Molecular Physics and Thermodynamics

1. Kinetic Molecular Theory of Gases (KMT).

Atomic Concept on the Structure of Molecules.

General Notions in Molecular Physics.

2. Kinetic Theory of Ideal Gases

The Ideal Gas Model.

Temperature and KMT.

Joule's law. Equation of Ideal Gas.

3 .Basic concepts of thermodynamics

General notions.

The General Principle and Zeroth Low of Thermodynamics.

Temperature in Thermodynamics.

4. First Low of thermodynamics

Thermodynamics and Energy.

Heat, Work and Calorimetry.

Heat coefficients.

Ideal Gas Thermodynamics: Specific Heats, Isotherms, Adiabats.

5. The Second Low of Thermodynamics

Heat Engines.

The Second Low for Bitermal cyclic transformations. The Carnot Cycle.

The Second Low for Nonstatic-Irreversible Processes

The Third Low of Thermodynamics

III. Optics

The Fundamental Laws of Geometric Optics

Reflection and refraction of Light Rays

Optical prism and Optical Lenses

Optical Instruments

IV. Atomic and Nuclear Physics

Elementary Atomic and Nuclear Physics

Atoms and Electromagnetic Waves

Nuclear Models. Nuclear Properties.

Nuclear Decay and Radioactivity.

V. Applications of Physics in Engineering Sciences

Computer programming and programming languages I - Cornelia GYŐRÖDI

1. Introduction to Programming in C
2. Structured Programming in C
3. Control structures in C
4. Variables, operators and expressions
5. Functions in C
6. Array type in C
7. Pointers in C
8. Strings in C
9. Structures and unions in C
10. Recursion
11. Bitwise fields
12. Dynamic structures
13. Input/Output (I/O) functions for files

Mechanics – Tiberiu BARABAŞ

1. Fundamentals

2. Statics of a Particle
3. Statics of a Rigid Body
4. Kinematics of a Particle
5. Kinematics of a Rigid Body
6. General theorems and methods in Dynamics

Applied informatics – Viorica SPOIALĂ

1. Arithmetic and logic basis of a computing system
2. Computing systems
3. Operating systems
4. Microsoft Office 2010 suite (Word, Excel, PowerPoint)
5. Algorithms

Analysis and synthesis of digital devices – Erica MANG

Foreign language (English) I – Simona ABRUDAN CACIORA

1. Introductory Seminar. Reading the text entitled "Tools"; Vocabulary and conversation exercises.
2. Materials and Containers. Reading, introducing new phrases, applicative exercises. Cardinal and Ordinal Numerals: Revision.
3. Shapes and Angles. Reading, introducing new words. The plural of nouns: Revision and exercises.
4. Engines (I). Text reading, vocabulary exercises. Countable and uncountable nouns (revision exercises).
5. Engines (II). Text reading, conversation. Number of invariable nouns (revision and exercises).
6. Engines and Fuels. Modal verbs - revision
7. Current, Voltage and Resistance. Text reading. The Present Tense Simple and The Present Tense Continuous (Revision and exercises).
8. Electrical Supply. Reading, Speaking. The Past Tense Simple and The Past Tense Continuous (Revision and Exercises).
9. Facts about matter. Listening and conversation. The Present Perfect versus The Past Tense
10. Circuits and Components. Reading and vocabulary exercises. The Present Perfect Continuous and The Past Tense Continuous.
11. Electrolysis. Reading and conversation based on the text. The Past Perfect Tense Simple and Continuous (Revision and Exercises)
12. Electrical Devices. Communication. Reading and expression of opinions.
13. Batteries. Methods of structuring and writing a descriptive essay. The complex verb "To call".
14. Revision: Cardinal and ordinal numerals, the plural of nouns, means of expressing the present and the past in English.

Physical education and sport I

1st year of study – 2nd semester (spring)

Special mathematics – Dorina FECHETE

1. First-order ordinary differential equations
   - Generalities
   - Separable equations
   - Euler homogeneous equations
   - Linear differential equations
   - Existence and uniqueness of solutions
   - Numerical methods for ordinary differential equations
2. Higher order differential equations
   - Generalities
   - Reduction of order
   - n-th order linear differential equations

- n-th order linear differential equation with constant coefficients

3. Systems of linear differential equations
   - General properties
   - Solution formulas
4. Differential operators
5. Fourier series
6. Fourier transform
7. Laplace transform

Theory of probability and mathematical statistics – Ovidiu NOVAC

I. PROBABILITY THEORY ELEMENTS

I.1. Probability field. (Event field, Probability field, Probability, Independent events, Dependent events, Conditional probabilities, Total probability formula, Bayes formula).

I.2. Probabilistic schemes. (Binomial scheme, Multinomial scheme, Poisson scheme, Unbalanced bile scheme, Pascal Scheme)

I.3. Random variables (Distribution Functions - Probability Density - Numeric Attributes of Distribution Functions - Random Variable Operations - Probability Density Convolution)

I.4. Numeric characteristics of random variables (Media, Dispersion, Initial Moments and Centered Moments of r order. Cebishev's Inequality).

I.5. Random vectors. Distribution function. Probability density. Marginal distributions. Covariance. Coefficient of correlation. Regression.

I.6. Characteristic function. Definition. Properties.

I.7. Classical probabilistic distributions. (Binomial distribution, Poisson, hypergeometric, Pascal and normal, uniform, Gamma, Beta, exponential, HI square, Student, Fischer-Snedecor).

II. MATHEMATICAL STATISTICS ELEMENTS

II.1. Selection theory elements. Distribution of selection data. Media and selection dispersions.

II.2. Estimation theory elements. Types of estimates. Methods for determining the estimates. Maximum Verosimile Method. Trust interval method.

II.3. Checking statistical assumptions. Media tests: Z Test, T Test, tests on dispersion, Hi Square Test, F Test.

Computer programming and programming languages II – Simina COMAN

1. Introduction - data structures, static and dynamic data types, evaluation of the algorithms performance
2. Search and sort algorithms for static data structures - search algorithms in arrays, algorithms for array sorting
3. Array data types – functions, search techniques
4. Recursive algorithms – division algorithms, backtracking
5. List data structures
6. Dispersion technique

Electrotechnics I – Teodor LEUCA

1. Linear electric circuits in stationary regime
2. Non-linear electric circuits in direct current
3. Linear electric circuits in permanent sinusoidal regime

Linear electronic circuits I – Simona CASTRASE

1. Electrical signals. Laws and theorems of electronic circuits
2. Passive circuit elements. Electrical resistance. Capacitor. Coil.
3. Passive Components Circuits.
4. Semiconductor diodes. Rectifier diodes.
5. Zenner diode.
6. Bipolar transistor.
7. Field effect transistor (FET)
8. Thyristor. Applications.
9. Transistor unity Structure (TUJ)

10. Semiconductor optoelectronic devices.

Computer aided graphics – Maria DURGĂU

1. Presentation of the AutoCAD operating mode. The AutoCAD User Interface. Launching orders. Data input. Selecting objects. Display Control. Establishing the drawing environment. End of work session.
2. Use basic commands for drawing, editing, and specifying entity-specific points. Draw commands for base entities. Commands used to modify and edit drawings. Using Object Snap Modes (Object SNAP). Selection sets.
3. 3.Using the UCS coordinate system in plane drawing (2D). Orders for making connections and bevels. Orders that allow copying, moving, scaling, and splitting entities.
4. General rules for the execution of the technical drawings Lines used in the technical drawing. Formats of technical drawings. Indicator. Numerical scales used in the technical drawing. Standardized writing. Representations used in industrial design: Representation in double and triple orthogonal point projection.
5. Orthogonal representation of the straight. Double Orthogonal Projection of the Straight. Triple Orthogonal Projection of Straight.
6. Rules for the representation and marking of views and sections. Layout of the projections in the plan. Classification of views. Section representation of parts. Classification of sections. Notation of section sectioning path.
7. Use of commands for quoting drawings. Rules and quotation rules. Elements of quote. Symbols used for enrolling quotas. Quoting specific elements. Classification of allowances. Quoting methods.
8. Quoting drawings with AutoCAD. Configuring Query Elements. Print text. Text style. Text input
9. Viewing a drawing. Hatching and representing breaks. Study some drawing display commands. Hatching. Hatch styles. Representation of ruptures.
10. Using Layers. Layer Definition. Create and modify layers. Determining the color and layer type of layers. Define blocks. Studying commands for creating and inserting blocks into AutoCAD.
11. Elements of 3D Modeling and Visualization. Introduction to 3D modeling. Types of three-dimensional models. Superficial models. Coordinate systems in 3D. Creating surfaces. Modeling solids. Generating Solids. Editing Solid Objects. Quoting in 3D
12. Presentation of the OrCAD Capture program. Present the steps required to create the electrical schemes using the OrCAD Capture program.

Operating systems in automation – Dragoş SPOIALĂ

1. Introduction to operating systems
2. UNIX operating system. Case Study
3. The UNIX file system. Case studies
4. Managing files and folders. Case studies
5. Text editors. Case studies
6. Processes. Case studies
7. UNIX Shells. Case studies
8. Unix-Linux network configurations and services
9. Security features of Unix-Linux systems
10. Unix-Linux graphical environment. Case studies

Foreign Language (English) II – Simona ABRUDAN CACIORA

1. Properties of Engineering Materials (I). Reading and conversation. Paragraph building (Structure of a paragraph, linking words).
2. Ferrous Metals. Reading. Means of expressing the future (I)
3. Tensile Strength and Hardness. Reading of texts, means of expressing opinions. The Future Perfect.
4. Properties of Engineering Materials (II). Newspaper Articles The complex verb "To Fall".
5. Solders. Reading. The Infinitive (Revision and Exercises)
6. Speaking Practice. Complex verbs: "To Take". Conversation and means of expressing points of view. Exercises with complex verbs.

7. Mechanisms. Listening to English texts and conversations. The Gerund and the Participle (Review and exercises).
8. Forces in Engineering. Reading, introducing new phrases, argumentation exercises.
9. Writing: Listing and Enumerating Arguments (Enumerating and organizing arguments in a written text). Applicative exercises.
10. The Hovercraft. Text reading, conversation.
11. Changing the Structure of Information in a Sentence: The Passive Voice. Applicative exercises.
12. The Subjunctive Mood. Revision and exercises.
13. Electrical generators. Reading and expressing opinions
14. Revision

Physical Education and Sport II

2nd year of study – 1st semester (autumn)

Object Oriented Programming – Mirela PATER

1. Fundamental concepts of OOP
2. Java bases. Language syntax
3. Object and Driver classes
4. Control structures
5. Strings and exceptions
6. Classes, Objects and Methods
7. Methods overloading
8. Nested classes
9. Inheritance
10. Polymorphism
11. Interfaces
12. Abstract classes
13. Collections

Systems theory I – Sanda DALE

1. General considerations on systems. Introductory concepts.
2. Functional characterisation on systems.
3. System's properties.
4. System's classification.
5. Smooth mono-variable linear control systems: time-models, transfer functions, time-delay systems, state-feedback systems, system's connections.

Measurements and transducers – Mircea GORDAN

1. Introduction.
2. Measurement errors.
3. Methods and means of electrical measuring. Metrological characteristics.
4. Means of electrical measuring in dynamic mode.
5. Analogue measuring instruments. Operating principles.
6. Digital measuring devices. Operating principles.
7. Measurement of current and electrical voltage.
8. Measurement of resistance and impedance.
9. Measurement of electrical power.
10. Measurement of electrical energy.
11. The acquisition system architecture and the architecture of analog data generation systems.
12. Electrical transducers.

Electrotechnics II – Teodor LEUCA

1. Triple phase electric circuits
2. Linear electric circuits in non-sinusoidal periodic regime
3. The linear electric circuits in transient regime
4. The electromagnetic field in electrostatic regime

5. The electromagnetic field in the electro-kinetic regime
6. The electromagnetic field in the stationary magnetic regime
7. The general (fundamental) laws of the electromagnetic phenomena

Digital Electronics I – Ioan BUCIU

1. Digital Concepts.
2. Number Systems. Operations and Codes.
3. Logic Gates.
4. Boolean Algebra and Logic Simplification.
5. Karnaugh Diagrams.
6. Combinational Logic Analysis.
7. Functions of Combinational Logic.

Linear electronic circuits II – Simona CASTRASE

1. Dynamic passive circuits.
2. Circuits in alternating sinusoidal mode.
3. Rectifiers
4. Signal filters.
5. Stabilization schemes.
6. Fundamental amplification circuits
7. Operational Amplifiers.
8. Oscillators.
9. Pulse circuits, dump circuits.

Numerical methods – Mihaela NOVAC

1. Matlab programming fundamentals.
2. Introduction in Matlab programming
3. Errors in numerical calculation (sources of error, absolute and relative errors, error propagation, measurement errors).
4. Numerical methods to solve algebric linear systems equations. Exact methods. (Gauss's elimination method, the inverse matrix method, the Gauss-Jordan method, LU factorization method.)
5. Numerical methods to solve algebric linear systems equations. Iterative methods. (The iterative method of Jacobi. Gauss-Seidel iterative method. Successful relaxation method).
6. Numerical methods to solve nonlinear equations (Bisect method, sequence method, false position method, resolution of nonlinear equation systems).
7. Interpolation (Lagrange interpolation polynomial, finite differences and generalized powers (Newton-Gregory polynomials with finite differences), Newton's divided differences formula, Spline functions).
8. Functions approximation (functions approximation using least squares method).
9. Numerical integration (Trapezoidal method, Romberg method, Simpson's method).
10. Numerical derivation (numerical derivation formulas using Taylor series expansion).
11. Numerical methods to solve differential equations (Euler's method, Milne's method, Runge-Kutta method).

Foreign Language (English) III – Simona ABRUDAN CACIORA

1. Introductory Seminar. Reading the text entitled "An Introduction to Computers"; Vocabulary and conversation exercises.
2. First Approach to Software. Reading, introducing new phrases, applicative exercises. Cardinal and Ordinal Numerals: Applications.
3. The Computers and their Processing Abilities. Reading, introducing new words. The plural of nouns: Revision and exercises
4. Major Computer Applications. Reading, vocabulary exercises. Countable and uncountable nouns (revision exercises).
5. Computers and Algorithms. Text reading, conversation. The number of invariable nouns (revision and exercises).
6. Human Intelligence vs. Artificial Intelligence. Text reading.

7. Computer Ergonomics. Text reading. Modal verbs (revision).
8. Levels of Intelligence. Reading, Speaking.
9. Lasers. Listening and conversation.
10. Uses of Ultrasound. Reading and vocabulary exercises.
11. The Electronic Brain. Reading and conversation based on the text.
12. Online communication: Internet and IT Vocabulary. Writing e-mails.
13. Robots. Reading of texts, expressing opinions.
14. Revision.

Physical Education and Sport III

2nd year of study – 2nd semester (spring)

Systems theory II – Sanda DALE

1. Discrete/numerical mono-variable linear systems.
2. System's analysis methods for smooth and discrete systems.
3. Non-linear systems. Basic concepts.
4. Non-linear systems. Specific analysis methods.
5. Control structures.

Digital Electronics II – Ovidiu NEAMŢU

1. Sequential logic circuits
2. Flip-flops type RS
3. Flip-flops type Master-Slave JK
4. D-type and T-type flip-flops circuits
5. Asynchronous counting
6. Synchronous counting
7. High capacity integrated counting
8. Registers
9. Parallel-serial and serial-parallel data converters
10. Monostable circuits
11. Memory circuits: ROM, PROM
12. RAM random access memories
13. Programmable clock circuits
14. Integrated circuits in dedicated applications

Signal processing – Romulus REIZ

1. Signals-definitions, classifications, usual signal examples
2. Fourier series
3. Fourier transform
4. Laplace transform
5. Sampling and reconstruction of signals
6. Signal modulation and demodulation (AM FM PM etc.)
7. Filter design
8. Pasive filters
9. Active filters
10. Digital filters

Industrial electrotechnics – Marius SILAGHI

1. Introduction in industrial electrotechnics
2. The single-phase electric transformer
3. Construction of DC machines
4. Construction of AC machines
5. Processing materials in electromagnetic field

Computer Architectures – Daniela POPESCU

1. Introduction – Terminology, Computer evolution and performance
2. Top-Level View of Computer – Function, Interconnections, Architecture

3. Memory – Internal memory (technologies)
4. Memory – Cache memory (Overview, Elements of Cache Design)
5. Memory – External Memory (magnetic Disk, RAID, Optical memory, Magnetic Tape)
6. Computer Arithmetic – Information representation, ALU, Adders
7. Instruction sets – Characteristics, Functions, Addressing modes, Formats
8. Processor structure and function. Reduced Instruction Set
9. Control Unit Operation – Micro-operations, Hardwire implementation, Microprogrammed Control
10. Input/Output – External devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors
11. Interconnection Structures – Bus, PCI
12. Operating System Support

Computer aided design in automation – Dragoş SPOIALĂ

1. Overview of the OrCAD 9 software package
2. Drawing electrical schematic design
3. Simulation of the electrical schematic designs with OrCAD PSPICE
4. Printed board circuits with OrCAD LAYOUT
5. Overview of the MATLAB software package
6. Arithmetic operations i Matlab software package
7. Generate vectors and common matrices with Matlab software package
8. Operations with matrices in Matlab software package
9. Instructions and control functions in Matlab software package
10. Common mathematical functions in Matlab software package
11. Numerical calculations with polynomials in Matlab software package
12. Numerical integration of differential equations in Matlab software package

Power electronics – Alexandru GACSÁDI

1. Introduction in power electronics. Electronic circuits. Objectives.
2. Power electronic switching devices. Stationary characteristics.
3. Power electronic switching devices. Dynamic characteristics.
4. Single - phase rectifiers.
5. Three - phase rectifiers.
6. Three - phase controlled rectifiers.
7. AC to AC power conversions.
8. Frequency changer.
9. Control of power electronic circuits.
10. Continuous voltage linear regulators.
11. DC to DC converters.
12. Switched-mode power supply.
13. Power inverters.
14. Three - phase power inverters.

Foreign Language (English) IV – Simona ABRUDAN CACIORA

1. Introduction: The structure of organizations and company.
1.1 The presentation of job titles.
1.2 Forms of Business Organization: Sole traders, partnerships, joint stock companies, private limited companies, public limited companies
1.3 Reading a conversation about career developments.
2. Discussion group: Assessment and evaluation of jobs. Task: Drawing an organization-chart, describing your job and your company
3. Understanding the organizational culture.
3.1 Reading about the international economic and the business environment
3.2 Leadership styles
3.3 The values of the organization.
3.4 Types of property in the USA and in Great Britain;

3.5 The Anglo-Saxon measurement system.
4. Role play: The dress code and behaviour standards.
5. Professional ethics 5.1 Professional ethics 5.2 International business ethics: specific vocabulary
6. Speaking Practice. Case-study: Talking about franchise opportunities.
7. Presentations: Types of presentations – Sales presentations, Informal presentations, Briefings, etc
8. Practices and techniques aimed to improve the students' telephoning skills: presentation, questions, demands, wishes.
9. Telephoning. Useful phrases: Getting connected, making requests, arrangements, offers, complaining, dealing with complaints..
10. Organizing effective meetings
10.1 Vocabulary related to planning and facilitating business meetings
10.2 Scheduling business meetings
10.3 Invitation1samples
10.4 Greeting and welcoming people
10.5 Chairing a business meeting.
11. Role-play: Organizing a business meeting.
12. Online communication.
12.1 Internet and IT Vocabulary
12.2 Writing e-mails.
12.3 Video-conferencing.
13. Discussion group: Theme – The evolution of online communication and its impact upon the business environment
14. Revision.

Physical Education and Sport IV

3rd year of study – 1st semester (autumn)

Systems with integrated programmable circuits I – Dragoş SPOIALĂ

1. Introduction
2. The information organization in systems with microprocessors
3. The central processing unit
4. The main memory systems
5. Input/output operations

Modelling and simulation – Laura COROIU

1. Mathematical models of systems and their identification
2. Modeling of continuous time systems
3. Modeling of Digital systems
4. Automatic process management
5. Controllers in automation

Transducers and sensors – Dan TONŢ

Electrical drives in automation I – Helga SILAGHI

1. Subject of electrical drives
1.1. Introduction in electrical drives
1.2. Structure and construction of electrical drive systems
2. General problems of electrical drives technology
2.1. The object of the kinematics and dynamics of electrical drives. Motion equation
2.2. Reporting of couples, moments of inertia, strength and mass
2.3. Mechanical characteristics of electric machines and working mechanisms
2.4. Transmission of the movement from the electric machine to the working mechanism
2.5. Electromagnetic couplings
2.6. Stability of electrical drives systems

3. Electrical drives with DC machines
3.1. General relationships and mechanical features for electrical drives with DC machines
3.2. Methods of starting for electrical drives with DC machines
3.3. Braking methods for electrical drives with DC machines
3.4. Speed control for electrical drives with DC machines
4. Electrical drives with asynchronous machines
4.1. General relationships and mechanical features for electrical drives with asynchronous machines
4.2. Methods of starting for electrical drives with asynchronous machines
4.3. Braking methods for electrical drives with asynchronous machines
4.4. Speed control for electrical drives with asynchronous machines

Experimentally systems identification – Claudiu COSTEA

1. Introduction to system identification.
2. Signals.
3. Collection and processing of primary data
4. Model classes.
5. Modelling and predicting time series.
6. Fundamentals of estimation theory.
7. Synthesis of models used for systems identification.

Electro-hydro-pneumatic equipment in automation – Tiberiu BARABAŞ

1. Passive components of electro-hydraulic equipment. Hydraulic resistors
2. Active components of electro-hydraulic equipment. Hydraulic amplifiers.
3. Applications of electro-hydraulic equipment in automation systems.
4. Passive components and circuits of electro-pneumatic equipment. Pneumatic resistors. Pneumatic capacity.
5. Active components of electro-pneumatic equipment. Regulators.
6. Applications of electro-pneumatic equipments in automation systems. Case studies.

Computer networks in automation – Dragoş SPOIALĂ

1. Introduction in computer networks. Classification
2. Networking programs
3. Reference models in networking
4. Examples of computer networks
5. The OSI Physical layer
6. Computer Network Infrastructure
7. The OSI Link Data layer
8. The OSI Network layer
9. The OSI transport layer
10. The OSI presentation and session layer
11. The OSI application layer

3rd year of study – 2nd semester (spring)

Systems with integrated programmable circuits II – Dragoş SPOIALĂ

1. Introduction
2. The multiprocessors systems with typically buses
3. The multiprocessor system design
4. The personal computers
5. The personal computers buses
6. The Pentium processor
7. The multiprocessor systems developing

Control systems engineering I – Bara ALEXANDRU

1. Introduction to Control Engineering
1.1 Concept of a system
1.2 Open-loop systems
1.3 Closed-loop systems

1.4 Time domain response of second order systems
1.5 Step response analysis and performance specification
2. Closed-loop control systems
2.1 Closed-loop transfer function
2.2 Block diagram reduction
2.3 Systems with multiple inputs
2.4 Controllers for closed-loop systems (P. PI, PD, PID)
2.5 The Ziegler-Nichols methods for tuning controllers
3. Classical design in the time domain (s – Plane)
3.1 Stability of dynamic systems
3.2 The Routh-Hurwitz stability criterion
3.3 Root-locus analysis
3.4 Compensators design in the s-plane
3.5 Control systems design with deadbeat response
4. Classical design in the frequency domain
4.1 Frequency domain analysis
4.2 Stability analysis in frequency domain(the Nyquist stability criterion)
4.3 Compensator design in the frequency domain
4.4 Delay time control systems design
5. State-Space Methods for Control Systems Design
5.1 The state-space approach
5.2 Controllability and observability
5.3 State variable feedback design
5.4 State observers

Programmable logic controllers – Eugen GERGELY

1. The computing systems and the industrial control.
2. The structure of programmable logic controllers.
3. Programming languages.
4. Special functions.
5. Programming methods.

Electrical drives in automation II – Helga SILAGHI

1. Asynchronous machines control systems with variable frequency supply
1.1. Mathematical model of the induction machine
1.2. Induction machine simulation using LabVIEW
1.3. Vector control systems for induction machine speed
2. Electrical drives with synchronous machines
4.1. General relationships and mechanical features for electrical drives with synchronous machines
4.2. Methods of starting for electrical drives with synchronous machines
4.3. Braking methods for electrical drives with synchronous machines
4.4. Speed control for electrical drives with asynchronous machines
3. Special electric drives with stepper motors
3.1 Design and operation of stepper motors
3.2 Stepper motors supply
3.3 Control structures of stepper motors
3.4 Field control of stepper motors with variable reluctance
4. Special electric drives with linear motors
4.1. Constructive types of linear motors
4.2. Linear motors applications
4.3. Mathematical model of linear motors
5. Special electric drives with piezoelectric motors

Microcontrollers in automatics – Viorica SPOIALĂ

1. Introduction in microcontrollers
2. 8051 microcontrollers - 80C51 and 8xC552 microcontrollers

3. PIC microcontrollers
4. AVR – Arduino microcontrollers

Discrete events systems – Liliana MATICA

1. Functionalities characteristics provided by sampling over time of systems with numeric processors (alias effect); sampling and into Z transformation, systems analysis with Z transformation. Real-time algorithms: numerical filtering algorithms; numerical control algorithms, PID discrete algorithm.
2. Characteristics of real-time programing in assembly language (for Intel microprocessors): position and speed real-time computation, development (in assembly language) the control for DC electrical motors.
3. Principles of numerical-analogical conversion and analogical- numerical-conversion.
4. About heating with geothermal water of our university.
5. Considerations regarding real-time process and Petri networks.

General Economics – Constantin RADA

1. Subject of general economics
2. Law character of economics
3. Economical activity
4. Economical needs and interests
5. The enterprise
6. Consumer behavior
7. The market
8. Economic competition
9. Selling prices
10. Consumption and savings
11. Economic growth
12. Entrepreneur's profit
13. Cyclicality of economic activities
14. Relations with the international market

4th year of study – 1st semester (autumn)

Adaptive and optimal systems – Bara ALEXANDRU

1. Optimal Control
1.1 Review of optimal control
1.1.1 Types of Optimal Control problems
1.1.2 Selection of Performance Index
1.2 The Linear Quadratic Regulator
1.3 The Linear Quadratic Tracking problem
1.4 The Kalman Filter
1.4.1 The State Estimation Process
1.4.2 The Kalman Filter Single Variable estimation problem
1.4.3 The Kalman Filter Multivariable state estimation problem
1.5 Linear quadratic Gaussian Control system design
1.6 Robust Control
1.6.1 Classical Feedback Control
1.6.2 Internal Model Control (IMC)
1.6.3 IMC Performance
1.6.4 Structured and unstructured model uncertainty
2. Adaptive control
2.1 Introduction
2.2 On-line Parameter Estimation
2.2.1 Scalar Case (Examples)
2.2.2 Vector Case
2.2.3 Adaptive Laws with Normalization

2.2.3.1 SPR-Lyapunov Design Approach
2.2.3.2 Gradient Method
2.2.3.3 Least-Squares Method
2.3 Model Reference Adaptive Control
2.3.1 Simple Direct MRAC Schemes
2.3.2 MRC for SISO Plants
2.3.3 Direct MRAC with Normalized Adaptive Laws
2.3.4 Indirect MRAC with Normalized Adaptive Laws
2.4 Adaptive Pole Placement Control
2.4.1 Simple APPC Schemes
2.4.2 PPC: Known Plant Parameters
2.4.3 Indirect APPC Schemes
2.5 Robust Adaptive Laws
2.5.1 Plant Uncertainties and Robust Control
2.5.2 Instability Phenomena in Adaptive Systems

Control systems engineering II – Bara ALEXANDRU

1. Nonlinear systems analysis
1.1 Phase Plane Analysis
1.1.1 Phase Portraits
1.1.2 Singular Points
1.1.3 Phase Plane Analysis of Linear Systems
1.1.4 Phase Plane Analysis of Nonlinear Systems
1.1.5 Existence of Limit Cycles
1.2 Fundamentals of Lyapunov Theory
1.2.1 Nonlinear Systems and Equilibrium Points
1.2.2 Concepts of Stability
1.2.3 Linearization and Local Stability
1.2.4 Lyapunov's Direct Method
1.2.5 System Analysis based on Lyapunov's Direct Method
1.2.6 Control Design based on Lyapunov's Direct Method
1.3 Advanced Stability Theory
1.3.1 Concepts of Stability for Non-Autonomous Systems
1.3.2 Lyapunov Analysis of Non-Autonomous Systems
1.3.3 Lyapunov-Like Analysis Using Barbalat' Lemma
1.3.4 Positive Linear Systems and The Kalman-Yakubovich Lemma
1.3.5 Absolute Stability
1.4 Describing Function Analysis
1.4.1 Describing Function Fundamentals
1.4.2 Common Nonlinearities in Control Systems
1.4.3 Describing Functions of Common Nonlinearities
1.4.4 Describing Functions Based Analysis of Nonlinear Systems
2. Nonlinear Control Systems Design
2.1 Feedback Linearization
2.1.1 Feedback Linearization and The Canonical Form
2.1.2 Input-State Linearization of SISO Systems
2.1.3 Input-Output Linearization of SISO Systems
3. Sliding Control
3.1 Sliding surfaces
3.1.1 Filippov's Construction of the Equivalent Dynamics
3.1.2 Direct implementations of Switching Control Law
3.2 Continuous Approximations of Switching Control Law
4. Control of Multi-Input Physical Systems
4.1 Robot Position Control

4.2 Robot Trajectory Control
4.3 Adaptive Robot Trajectory Control

Robotics – Tiberiu BARABAŞ

1. The general structure of industrial robots.
2. Basic kinematic computations used in the control of industrial robots
3. Basic control methods of industrial robots.
4. Modeling of the outside environment of an industrial robot.
5. Industrial robots programming.
6. Integration of industrial robots in flexible systems/manufacturing cells.

Automatic systems reliability – Sanda DALE

1. Quality concepts. Quality principles.
2. Fundamental quality indicators
3. Distribution laws
4. System's reliability
5. Reparable system's availability
6. Faults, failure, causes
7. Reliability/availability in Control Systems
8. Quality and reliability in design and manufacturing processes

Management – Marius ROMOCEA

Process interfaces – Gabriela TONŢ

1. Introduction to process interfaces.
2. Structure of a process interface
3. Computer ports and buses used to communicate with data acquisition devices.
4. MAX LabVIEW Utilitary (Measurement and Automation Explorer)

Command and control systems for electrical drives – Bara ALEXANDRU

1. Dynamics of Mechanical Drive
1.1 Elementary Principles of Mechanics
1.2 The Motion Equations of a Drive with Lumped Inertia
1.3 Two Axes Drive in Polar Coordinates
1.4 Mechanical Characteristics of Different Types of Motors and Loads
1.5 Operating Point Stability
1.6 Integration of the Simplified Equation of Motion
2. Separately Excited DC Machine
2.1 Dynamic models and Block Diagram
2.2 Control Methods
2.3 Dynamic Behavior of DC Motor al Constant Flux
3. DC Motor with Series Field Winding
3.1 Dynamic Model
3.2 Steady State Characteristics
4. DC Drives Control
4.1 General Schematic of DC Drive Control
4.2 Cascade Control of DC Motor
4.3 Control of Ward-Leonard Drive
4.4 DC Drives with two-quadrant converter
4.5 DC Drives with four-quadrant converter
5. Three-Phase AC Machines
5.1 Mathematical Model of a General AC Machine
5.2 Steady State Characteristics
5.3 Control of Induction Motor Drives
5.3.1 Control of Induction Motor Based on Steady State Machine Model
5.3.2 Rotor Flux Orientated Control
5.3.3 Stator Flux Orientated Control

5.3.4 Air Gap Flux Orientated Control
5.4 Variable Frequency Synchronous Motor Drives
5.4.1 Control of Synchronous Motors with PM Excitation
5.4.2 Cycloconverter-fed Synchronous Motors
6. Applications of Controlled Drives
6.1 Speed Controlled Drives
6.2 Linear Position Control

4th year of study – 2nd semester (spring)

Industrial robots control – Liliana MATICA

1. Industrial robots and automatic manufacturing systems; general considerations.
2. About establish the trajectories in with fixed obstacles (homogeneous cells method …)
3. Mobile platforms (Arhetip module; Steward module; 3x3 module from Sibiu …); computation of kinematics joints parameters (with vectors computations).
4. Kinematics of the robotic arms, according Denavit-Hartenberg convention; computation of direct and inverse kinematics about an robotic arm type about RRRRRR (relative position of two Cartesian coordinate systems, homogenous transformation, programmable parameters of kinematics joints …) .
5. Real-time computation of location matrix (position vector and orientation versor) during an imposed linear or circular trajectory (with constant or variable orientation of robotic arm TCP – tool center point), (spherical coordinates). Computation of Lagrange polynomial (grade 'n') for trajectories traversing 'n+1' imposed points (defined with Cartesian coordinates).
6. Motion stages (acceleration, deceleration); speed profile (mixt profile of speed, during a motion upon an imposed linear or circular trajectory).
7. Considerations regarding robotic arm motion programing language, (for example, ACL language), (Peak and Roll angle …), real-time execution (parallel tasks, real-time synchronization …); DTPS software.

Control systems informatics – Eugen GERGELIY

1. Analog signals.
2. PLC closed loop control and intelligent modules.
3. Distributed PLC systems.
4. The man-machine interface.
5. Practical aspects.

Industrial informatics systems – Liliana MATICA

1. Industrial process informatics – definitions; morphology, cohesion. Industrial software system fully factorized; structure of a maintainable software systems.
2. Real-time tasks, states (stages) and sub-states of tasks, multitasking operations, the traffic light mechanism, mechanism of event variables, mailbox mechanism, examples about multitasking operations implementations with those mechanisms.
3. Real-time algorithms for imposed trajectories traverse (difference analysis algorithms, direct functions computation, spline functions, Newton or Hermite polynomial for trajectory traverse).
4. Expert systems for implementing artificial intelligence; about three-phase electrical circuits for electrical energy distribution and its real-time monitoring; ANOP IRAP module of DENIS expert system (about endangered equipment), examples of real-time intervention.
5. About OPC (Open Process Control) – defining consistent methods of accessing field data from plant devices, in purpose to provide a common bridge for process control hardware.

Fuzzy systems and neuronal networks – Sanda DALE

1. Introduction. Knowledge-based Systems.
2. Fuzzy systems. Fuzzy logic elementary concepts.
3. Fuzzy control systems.
4. Interpolative control systems based on rules.
5. Neural control systems. Fundamental concepts on neural networks (ANN)

6. Paradigms or ANN architectures.
7. Aspects on neural control of processes.

Advanced control systems – Sanda DALE

1. Introduction in control systems. Discrete control systems.
2. Discrete systems analysis methods.
3. Discrete systems design methods.
4. Discrete control structures implementation.