Course title	Aplication of Microprocessor
Course code	KE/IAME
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Novák Jaroslav, doc. Ing. CSc.
* Hájek Martin, Ing.

Objective

This course provides students with the modern applications of microcomputers, especially in embedded designs. Course evolves knowledge from IMTEE course.
Ability of individual developing of embedded systems with microcomputers.

Prerequisities

KE/IMTEE

Course contents

Electronics circuits with microprocessors - power supply, reset circuits, brown-out detectors, watchdog and oscillators. I/O ports - types and their properties. AVR I/O ports - block diagram, DC characteristics.
Microcontrollers Timers and counters - Basics principles, usage to timing os systém, measuring of Digital signals. Special modes - input capture, Output Compare, PWM.
Man-machine interface - LED, LCD and graphics displays, connection to microcomputers. Keypads, Rotary encoders, remote control of units. Expansion of microcontroller inputs and outputs.
A/D and D/A converters - types, basics principles and properties, connection to microcomputers. Voltage references, analog input circuits.
Serial buses I - RS422, RS485
Serial buses II - SPI, I2C - physical layer, circuits, properties. Multimaster mode of I2C - arbitration and clock synchronization.
CAN bus - physical and network layer, using in automotive
Wireless networks in embedded systems - frequency bands, common topologies (point to poit, MESH networks, stars), wireless standards (ZigBee, BlueTooth, WiFi)
ARM core microcomputers - introduction to architecture, instruction set, ARM7 and ARM9 cores.
Operating systems in embedded systems I - real time concepts, OS principles (multitasking, scheduler, process states).
Operating systems in embedded systems I - Windows CE, Linux, .NET micro framework.
Digital Signal Processors - specifics of architecture, instruction set and application developing. SHARC DSP from Analog Devices.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Demonstrace

Assesment methods

Písemná zkouška, Posouzení zadané práce, Rozhovor

Recommended reading

* Firemní literatura firmy Atmel. <I>dostupná na www.atmel.com</I>.
* Firemní literatura firmy Intel. <I>dostupná na www.intel.com</I>.
* Foremní literatura firmy Analog Devices. <I>dostupná na www.analog.com</I>.
* Mann, B. <I>C pro mikrokontroléry, BEN - technická literatura, Praha 2003, ISBN 80-7300-077-6</I>.
* Váňa, V. <I>Mikrokontroléry Atmel AVR - assembler, BEN - technická literatura, Praha 2003, ISBN 80-7300-093-8</I>.

Course title	Algorithms and Introduction to programming
Course code	KE/IAZPE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Dušek František, doc. Ing. CSc.
* Rozsíval Pavel, Ing.
* Pola Marek, Ing.

Objective

This course is introduction to programming. The main course objective is to manage out basics programming techniques in C# language and algorithm development. Students also meet with developing and debugging of programs in Microsoft Visual Studio developing environment.
Procedurally oriented programming in C# language, developing simple algorithms.

Prerequisities

Course contents

Introduction to course, algorithms - definition, properties. Firs program in C#.
Introduction to C# - data types, variables, assignment, arithmetic operators and expressions. Basics I/O operation.
Logic and relational operators and expressions. Control structures II - block, branch statement, cycles I (for)
Control structures II - cycles I (while, do-while, break, continue), switch statement. Representation of various kinds of data in computer memory. Introduction to data types.
Conversion between data types. Methods - definition, calling. Commentaries.
Passing parameters to methods by value and reference. Methods overloading. Mathematics functions.
One dimensional and more dimensional arrays - creating, working with. Arrays and Methods.
Sorting algorithms - bubble, insert, select sort. Using sorting and searching algorithms implemented in .NET class library.
Searching algorithms - linear and binary search. Errors in programs. Introduction to exceptions.
Chars encoding - ASCII, Unicode. Chars and strings in C#.
Files - introduction, binary and text files, opening and closing files. Reading and writing to text files in C#.
Introduction to computational complexity theory.
Extended markup language (XML).

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Demonstrace

Assesment methods

Písemná zkouška, Posouzení zadané práce, Rozhovor

Recommended reading

* Gunnerson, E. <I>Začínáme programovat v C#. Computer Press, 2001</I>.
* Liberty, J. <I>Programming C#, O´Reilly, 2001</I>.
* Nagel, Ch., Evjen, B., Glynn, J., Skinner, M.W. <I>C# 2005 - Programujeme profesionálně</I>. Brno: Computer Press, 2007. ISBN 80-251-1181-4.
* Virius, M. <I>C# pro zelenáče. Neocortex</I>. KOPP. ISBN 8072321765.

Course title	Bachelor Thesis
Course code	KE/IBAPE
Type of course	Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	10
Language	CZ

Name of lecturer

* Němec Zdeněk, Ing. Ph.D.

Objective

Bachelor thesis means individual student work under supervisor leading. Student select on them from communication engineering and microcontroller technology themes.
Practical special activity.

Prerequisities

Course contents

Subject must fulfill bachelor thisis submission.

Teaching methods

Dialogická (diskuze, rozhovor, brainstorming)

Assesment methods

Ústní zkouška

Recommended reading

* <I>Dle cílů a obsahu zadání bakalářské práce.</I>.

Course title	Bachelor Course
Course code	KE/IBASE
Type of course	Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	2
Language	CZ

Name of lecturer

* Němec Zdeněk, Ing. Ph.D.

Objective

At seminar are students well - informeds about needs rapid - fire on diploma work , about
hers content and formal adjustment. Is them directed and progress at searching needed
information, at elaboration personal BP and preparation on hers defence. Further are them provided tuition from articles baccalaureate examination.
Seminar will give to students instruction on elaboration baccalaureate work technically and recommendation to preparation defences BW.

Prerequisities

Course contents

Requests to Bachelor work.
Work methodology.
Elaboration stages of Bachelor work.
Structure of Bachelor work.
Content of Bachelor work.
Format style of Bachelor work.
Presentation of document.
Presentation of Bachelor work.
Time reserve and other information.

Teaching methods

Dialogická (diskuze, rozhovor, brainstorming)

Assesment methods

Ústní zkouška, Posouzení zadané práce

Recommended reading

* <I>Dle cílů a obsahu zadání bakalářské práce.</I>.

Course title	Digital signal processing
Course code	KE/IDIZE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Konečný Jiří, Ing. Ph.D.
* Marek Josef, Ing. CSc.

Objective

To acquaint students with basics of digital signal processing.

Elementary knowledge from the field of DSP.

Prerequisities

Course contents

Introduction to digital signal processing (DSP), incorporation into studiing programme, advantages, disadvantages, signal classification, signal properties.
AD and DA converters as a part of DSP systems, principles, basic characteristics, examples
Discrete in time, discrete in amplitude signals, periodic signal decomposition, frequency spectra before and after sampling, sampling period and amplitude resolution needs for non distorted transmition of discretized signal.
Discretization by rounding and cutting, quantization error determination by probabbility theory tools.
Direct and backward Fourier transform as a limit case of Fourier series decomposition, amplitude and phase spektrum.
Other signal characteristics - mean value, power, energie, autocorrelation, correlation,
Linear time-invariant systems - basic systems for DSP.
System response evaluation for general input, impulse and unite step response, convolution,
Digital filters, sorts and realization.
Finite impulse response digital filters.
Infinite impulse response digital filters.
Discrete Fourier transform and FFT usage for filter realization.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Davídek, V., Sovka, P. <I>Číslicové zpracování signálu a implementace</I>. ČVUT.
* PRCHAL, J., ŠIMÁK, B. <I>Digitální zpracování signálů v telekomunikacích</I>. ČVUT Praha, 2000.
* Uhlíř J., Sovka P. <I>Číslicové zpracování signálu a informací, Skripta ČVUT</I>.

Course title	null
Course code	KE/IDSDK
Type of course	no contact
Level of course	Ph.D.
Year of study	0
Semester	ZS+LS
Number of credits	0
Language	CZ+AN

Name of lecturer

* Bezoušek Pavel, prof. Ing. CSc.

Objective

The goal is to make students familiar with the theory of digital modulator, linear and non-linear modulations without memory is memory and theory of optimal income and detection in the basic channel models.
Digital Communication Theory

Prerequisities

Course contents

Basic characteristics of the modulator: modulator linearity and non-linearity, stationarity, memory modulator.
Multistate single carrier modulation: PAM, ASK, PSK, APSK, FSK.
Modulation with many carriers: MTM, OFDM.
Basic models of communication channels: additive with AWGN, LTI, nonlinear with AM / AM and AM / PM, a random linear channel.
Optimum receivers and signal detection algorithms: MAP criterion, ML estimation of parameters of the input signal receivers, optimal receiver of the signal space, the correlation receiver. Receiving modulation of memory: Viterbi algorithm. Symbol error probability, the message bit for the different types of modulation. Synchronization, separate sync, ISI, model of a linear channel with discrete-time equalization, linear equalization, MLS equalization, blind equalization, using Viterbi algorithm, nonlinear distortion of AM / AM and AM / PM).

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* COUCH, L.W.:. <I>Digital and analog communication systems</I>. Prentice Hall, 2001. ISBN 0-13-081223-4.
* KAY, S. M.:. <I>Fundamentals of Statistical Signal Processing - Detection Theory</I>. Prentice Hall, 1993.
* KAY, S. M.:. <I>Fundamentals of Statistical Signal Processing - Estimation Theory</I>. Prentice Hall, 1993.
* PROAKIS, J. G.:. <I>Digital Communication</I>. McGraw Hill, Inc., 3 rd ed, 1996.
* SÝKORA, J.:. <I>Teorie digitální komunikace</I>. ČVUT Praha, 2005. ISBN 80-01-02478-4.

Course title	null
Course code	KE/IDSMK
Type of course	no contact
Level of course	Ph.D.
Year of study	0
Semester	ZS+LS
Number of credits	0
Language	CZ+AN

Name of lecturer

* Fišer Ondřej, doc. Ing. CSc.
* Schejbal Vladimír, prof. Ing. CSc.

Objective

The aim of the course is to acquaint students with the theory of signal propagation in a complicated time-varying environment, the movement of the transmitter and receiver.
Signal propagation in mobile communications

Prerequisities

Course contents

The content of the course is on the following topics: Propagation of electromagnetic waves near the ground, in the atmosphere and ionosphere (random nature of the spread).
Dissemination of electromagnetic waves in an environment with obstacles - the buildings, inside buildings.
Dissemination ultrasignals.

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* ARMAND, N. A., POLYAKOV, V. M.:. <I>Radio Propagation and Remote Sensing of the Environment</I>. CRC Press, 2005.
* SIZUN, H.:. <I>Radio Wave Propagation for Telecommunication Aplications</I>. Springer, 2003.
* SÝKORA J.:. <I>Teorie digitální komunikace</I>. ČVUT Praha, 2005. ISBN 80-01-02478-4.
* TAYLOR, J. D.:. <I>Ultrawideband radar technology</I>. CRC Press LLC, 2001. ISBN 0-8493-4267-8.

Course title	null
Course code	KE/IDSRS
Type of course	no contact
Level of course	Ph.D.
Year of study	0
Semester	ZS+LS
Number of credits	0
Language	CZ+AN

Name of lecturer

* Bezoušek Pavel, prof. Ing. CSc.

Objective

The aim of the course is to introduce the theory and methods of measurement generalized location of foreign objects, systems, active and passive radar and principles of statistical signal processing in radar.
Theory of modern radar systems

Prerequisities

Course contents

Principles of radar systems: primary radar, secondary radar, passive radar, bistatické, multistatické.
Distance measurement of the position angle and velocity using electromagnetic waves: resolution, clarity and accuracy.
Scattering of electromagnetic waves on objects: the classification of objects, description of the variance, the statistical properties of scattering and implications for the detection of objects.
Influence of electromagnetic waves propagation in the atmosphere, the ionosphere, in the presence of obstacles and terrain characteristics of the radar systems.
Radar equation: basic equation, the equation of a limited range of noise, veil, cover and search equation: derivation, consequences.
Radar systems: primary radar coherent and incoherent (HPRF, LPRF, LPI), secondary radar (ATC, SAR), passive radar coherent and incoherent (TOA, TDOA, DOA, Doppler., PCL), bistatické, multistatické.
Customized filtering and pulse compression, the function of uncertainty of radar signals.
Doppler filtering, detection, CFAR.
Association and the monitoring of targets and trajectories, Kalman filtering, the issue many goals - startup, PHD method, model search multičásticový position of many goals.

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* BARTON, D. K.:. <I>Modern radar system analysis, Artech house</I>. 1988. ISBN 0-89006-170-X.
* BEZOUŠEK, P., ŠEDIVÝ, P.:. <I>Radarová technika</I>. null. ČVUT Praha, 2. vyd., 2007. ISBN 978-80-01-03036-3.
* GALATI, G., et al.:. <I>Advanced radar techniques and systems</I>. Peter Peregrinus, Ltd.,, 1993. ISBN 0-86341-172-X.

* KAY, S. M.:. <I>Fundamentals of Statistical Signal Processing - Detection Theory</I>. Prentice Hall, 1993.
* KAY, S. M.:. <I>Fundamentals of Statistical Signal Processing - Estimation Theory</I>. Prentice Hall, 1993.
* NATHANSON, F. E.:, REILLY, J. P., COHEN, M. N.:. <I>Radar design principles, signal processing and the environment</I>. 2nd edition, 1999. ISBN 1-891121-09-X.
* SHEER, J. A., KURTZ, J. L.:. <I>Coherent radar performance estimation</I>. Artech House, 1993. ISBN 0-89006-628-0.
* STEVENS, M. C.:. <I>Secondary surveillance radar</I>. Artech House. ISBN 0-89006-292-7.
* WILLIS, N. J., GRIFFITHS, H. D.:. <I>Advances in Bistatic Radar</I>. Scitech Publishing, Inc., 2007. ISBN 1891121480.

Course title	null
Course code	KE/IDSZS
Type of course	no contact
Level of course	Ph.D.
Year of study	0
Semester	ZS+LS
Number of credits	0
Language	CZ+AN

Name of lecturer

* Filip Aleš, doc. Ing. CSc.

Objective

The aim of the course is to acquaint students with modern methods of signal processing.

Advanced Signal Processing

Prerequisities

Course contents

The content of the course are the following chapters: Random signals - characteristics of random signals in time and frequency domain.
Estimates of random and nenáhodných parameters. Cramer-Raova limit.
Formalized filtering and restoration of signals. Wiener filtering for continuous and discrete time.
Kalman filtering for continuous and discrete time, its use for modeling system
Adaptive filtering and identification. Adaptive filtering algorithms. Parametric methods of signal processing.
Time-frequency analysis, wavelet transform - a principle used for processing and compression of signals.
Multidimensional signals and spectra, selected integral transformation (Hadamard, Walsh, Haar wavelet transform and 2D).
Nonparametric methods for signal processing - analysis of eigenvalues and vectors of correlation matrices, the signal degradation and noise subspace, the chosen methods. Selected applications - identifying the direction of arrival of signals, frequency analysis with high resolution.

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* CASTLEMAN K. R.:. <I>Digital Image Processing</I>. Prentice-Hall, New Jersey, USA, 1996.
* KAY, S. M.:. <I>Fundamentals of Statistical Signal Processing - Detection Theory</I>. Prentice Hall, 1993.
* KAY, S. M.:. <I>Fundamentals of Statistical Signal Processing - Estimation Theory</I>. Prentice Hall, 1993.
* KAY, S. M.:. <I>Modern Spectral Estimation: Theory and Application.</I>. EngleWood Cliffs, New Jersey: Prentice-Hall, 1988.
* MADISETTI, V. K., WILLIAMS, D. B. (ed.):. <I>The Digital Signal Processing Handbook</I>. USA, CRC & IEEE Press,, 1998.
* MARPLE, S. L, Jr.:. <I>Digital spectral analysis with applications.</I>. Englewood Cliffs, Prentice-Hall, Inc., New York, 1987.

Course title	Electromagnetic Compatibility
Course code	KE/IELKE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Fišer Ondřej, doc. Ing. CSc.

Objective

This subject is aiming at making students acquainted with general questions of the electromagnetic compatibility (EMC) of electrical devices.
Student takes a bearing in the EMC field, differentiates interference sources as well as various ways of interference transmissions, he/she is able to suggest solutions to minimize the interferences. Student is also able to perform basic measurement methods of interference signal, he/she knows pertinent regulations.

Prerequisities

Course contents

Signification of electromagnetic compatibility (EMC) for the operation of electrical and electronic devices, definition of EMC as well as basic expressions (electromagnetic interference, electromagnetic immunity to a disturbance etc.), Examples of the EMC ignorance and its consequences, EMC legislature, impact of electromagnetic fields on live organisms.
Interference sources (industrial ones, natural ones), reasons of the overvoltage rise.

Interference types (noise, impulsive disturbance, continuous disturbance, quasi impulsive disturbance).
Disturbance signal transmission to the affected object (electromagnetic wave propagation in space, signal propagation along a line, attenuation and phase determination, various types of coupling).
Protection limiting the interferences (suppressor capacitors, suppression chokes, filters, electromagnetic shielding).
Protection against the overvoltage (arrester spark gap, lightning arrester, varistors, Zener diodes, suppressor diodes, fuses.
Measurement for electromagnetic compatibility (antennas for measurement, EMC chamber, free space measuring

site, devices for interference measurement.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody samostatných akcí, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* BEZOUŠEK, P., SCHEJBAL, V., ŠEDIVÝ, P. <I>Elektrotechnika</I>. Univerzita Pardubice, 2008.
* Hudec, J. <I>Přepětí a elektromagnetická kompatibilita</I>. Hakel, 1996.
* Kováč, D., Kováčová, I., Kaňuch, J. <I>EMC z hlediska teorie a aplikace</I>. BEN, 2006.
* Macháč, J. <I>Základy elektrotechnického inženýrství II.</I>. ČVUT, 1998.
* SCHEJBAL, V. et al. <I>Elektrotechnika. Příklady</I>. Univerzita Pardubice, 2004. ISBN 80-7194-560-9.
* Svačina, J. <I>Elektromagnetická kompatibilita: principy a poznámky</I>. Brno, VUT, 2001.
* Svačina, J. <I>Základy elektromagnetické kompatibility,VUT Brno, 2001.</I>. Brno: Vysoké učení technické, 2001.
* Svoboda, J., Vaculíková, P., Vondrák, M., Zeman, T. <I>Základy elektromagnetické kompatibility</I>. ČVUT, 1993.

Course title	Electrical Measurement
Course code	KE/IEMRE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Karamazov Simeon, prof. Ing. Dr.
* Němec Zdeněk, Ing. Ph.D.
* Losenický Miroslav, Ing. CSc.
* Jaroš Otakar, Ing.
* Pola Marek, Ing.

Objective

The students have to know basic principles of the measuring methods, they have to be able to propose measuring circuits and elaborate the results.
The methods for measuring of DC and AC variables, harmonic and nonharmonic signals, convertors A/D , D/A.
Special types of the analog and digital measuring instruments are discussed.
The influence of the disturbances.

The students acquire theoretical and practise knowledge in measuring circuits, sensitivity of the instruments, resolution, accuracy, accuracy type of the analog instruments, principles of the analog instruments, measuring U, I - AC,DC, measurement of the phasor U, I, measurement of the general impedance.

Prerequisities

KIT/IFY1E

Course contents

Measuring errors, measuring circuits, sensitivity of the instruments, resolution, accuracy, accuracy type of the analog instruments.
Principles of the analog instruments.
Measuring convertors U/f, f/U, U/U, U/I, I/U, I/I; principle of the feedback, operational amplifier.
Measuring of the summation, difference, product, quotient and integral.
Numerical integration, time sampling, types of the disturbances.
Convertors A/D, D/A, compensation types, comparison types, with weighting resistors, with resistor net R-2R.
Measuring U, I - AC,DC (small, medium, intensive).
Achievement, electrical work (energy), wattmeter - principle.
Frequency.
Electrical resistance (small, medium, intensive).
Inductivity, capacity.
Oscilloscope (principle of the analog types).
Oscilloscope (principle, features, preference).
Logic analyzer.
Vector voltmeter.
Measurement of the phasor U, I (harmonic signals).
Measurement of the general impedance.
Serial substitute circuits (L, C), parallel substitute circuits (L, C).
Measurement of the extremely small or extremely big resistances.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Laborování

Assesment methods

Ústní zkouška, Posouzení zadané práce, Analýza výkonu studenta

Recommended reading

* Bareš, L. <I>Elektrická měření I., II.</I>. Pardubice, Skriptum UPa, 2007.
* Bezoušek, P., Schejbal, V. <I>Elektrotechnika, UPa 2001</I>.
* Fajt a kolektiv. <I>Elektrická měření, 1996</I>.
* Fajt. <I>Elektrická měření, 1987</I>.

Course title	Elecronical Power Sources
Course code	KE/IENZE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	4
Language	CZ

Name of lecturer

* Štěpánek Ladislav, Ing.
* Bezoušek Pavel, prof. Ing. CSc.

Objective

Subject describes fundamental principles and conception feeding sources used in electronic apparatus (interpret as behaviour rectifier, stabilizer with continuous and with switching regulation, jointing switching voltage and current electrical sources).

Students learn principles of over-voltage, under-voltage, heat and power protections. Fundamental models of electrochemical feeding articles are a part of the subject, along with a trend in development feeding sources, using modern parts and integrated circuits.
They are informed about design and production of electronic equipment;. mainly to design, construct and produce boards wiring printed (BWP)

Students will be able to design and calculate parameters of various feeding sources, including practical construction and implementation of boards wiring printed. He/she will be able to correctly apply the measurement methods and use fundamental measuring instruments to verify parameters of designed feeding sources, as well as theoretic knowledge.

Prerequisities

Course contents

Feeding source - input convertor, rectifier, filtration.
Voltage regulator tube - parametric, with reverse structure with connected regulation
electrical current regulators and integrated stabilizers.

Switching stabilizer - flyback converter
Switching stabilizer -forward converter
Switching stabilizer - push-pull converter),
Double switching stabilizer - double forward converter,
Tuned converter.
Directive districts switching stabilizers.
EMC (Electro- MagnetiCompatibility) and interference feeding sources
Switching source for computer PC , Combined sources with continous and switching stabilizers.
Protection - current, power and heat overload
Chemical and solar feeding sources.
CAD, CAE systems for electronics, system for designing board wiring printed
Process design of boards wiring printed (wiring diagram, netlist, dislocation parts, hand lead connection, autorother).
Postprocesses (Gerber, Excellon).
Development of electronic equipment (project, development prototype, attestation function, EMC (Electro-MagnetiCompatibility).
Preparing groundwork for production, technology production boards wiring printed
Measuring and testing boards wiring printed , technology shouldering.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Demonstrace, Laborování

Assesment methods

Písemná zkouška, Posouzení zadané práce

Recommended reading

* Abel. <I>Plošné spoje se SMD, návrh a konstrukce, Platan, Pardubice 2000. ISBN 80-902733-2-7</I>.
* Husák, M. <I>Napájecí zdroje v elektronice</I>. Praha, ČVUT, 1998.
* Krejčiřík, A. <I>Napájecí zdroje I.</I>. Praha, BEN, 1997.
* Lenk, J.D. <I>Simplified design of micropower and batery circuits</I>. Oxford, Butterworth-Heinemann, 1996.
* Šavel. <I>Materiály, technologie a výroba v elektronice a elektrotechnice, BEN, Praha 2004. ISBN 80-7300-154-3</I>.
* Záhlav. <I>Metodika návrhu plošných spojů. Skriptum ČVUT, Praha 2000. ISBN 80-01-02193-9 (skripta)</I>.

Course title	Electronic Circuits
Course code	KE/IEOBE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	3
Language	CZ

Name of lecturer

* Konečný Jiří, Ing. Ph.D.
* Bezoušek Pavel, prof. Ing. CSc.

Objective

The aim (objective) of the course (subject) is to acquaint (familiarize) students with basic electronic circuits, their electric schemes, functioning and electric quantity waveforms. Basic theory of circuit function for simplified conditions is completed with electronic circuits simulation with help of SPICE. With help of computer simulation the function of the circuit can be shown with details. Exercises are carried in laboratory.

After the study of this subject the student will understand the function of basic electronic circuits and will be able to design electronic circuits with desired characteristics.

Prerequisities

Course contents

Power supply circuits, supplies with one-way and two-way rectification, supplies with diode bridge (Graetz), filtration of the output (smoothing) with help of capacitor and self-induction coil (inductor). Multiphase rectification (six-pulse, twelve-pulse).

Stabilizers of power supplies for electronic equipments, analog and discrete stabilizers, safeguard and protection of power supplies. Special types of power supplies.

Electronic circuits with diodes - amplitude detector, phase detector, ring modulator, sample and hold circuit. Special electronic circuits with diodes - amplitude limiters, limiters with Zener diodes.

Basic circuits with "multilayer diodes" - thyristors and triacs (controlled rectifiers). Circuits for power control and switching.

Transistor switching amplifiers, their characteristics. Switching amplifiers with low delays, pulse amplifiers, switching amplifiers with inductive load (coils, transformers), bistable and monostable flip-flops.

Circuits with resonance circuits, amplifiers with resonance circuit, high frequency amplifiers, oscillators. Principles of oscillation, frequency multipliers, circuits with coupled inductors.

Various types of voltage and current transistor amplifiers for low-frequency and power applications.

Operational amplifiers and their using in various applications - amplifiers, comparators, filters, pulse circuits, oscillators.

Special circuits, namely integrated blocks.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Burian, Z., Krejčiřík, A. <I>Simuluj - simulace vlastností analogových elektronických obvodů</I>. BEN, 2002.
* DOBEŠ, J. <I>Návrh elektronických obvodů počítačem</I>. Praha ČVUT, 1994.
* Husák, M. <I>Napájecí zdroje v elektronice</I>. Praha, ČVUT, 1998.
* Krejčiřík, A. <I>Moderní spínané zdroje</I>. Praha, BEN, 1999.
* Krejčiřík, A. <I>Napájecí zdroje I.</I>. Praha, BEN, 1997.
* Mallat, J., Krofta, J. <I>Stabilizované napájecí zdroje pro mikroelektroniku</I>. Praha, SNTL, 1985.
* Mohan, N., Undeland, T. M., Robbins, W. P. <I>Power electronics</I>. New York, John Wiley, 1989.

Course title	Electronic Devices
Course code	KE/IESOE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Karamazov Simeon, prof. Ing. Dr.
* Štěpánek Ladislav, Ing.
* Jaroš Otakar, Ing.

Objective

The goal of the subject is to inform about the principle function and fundamental characteristics of electronic parts and their typical applications.
Students are especially taught about semiconductor parts: PN diodes, bipolar and homopolar transistors, thyristors, optoelektronicke parts, analog and digitalintegrated Circuits (operating amplifier, stabilizer, comparator).

Student will know function and utilization of whole series parts. Mainly semiconductor devices such as transistors, thyristors. thyristor etc. monolithic integrated circuit, hybrid integrated circuit and optical electronic devices. He/She will able to measure their parameters and design fundamental circuits.

Prerequisities

Course contents

Introduction:
Lead current at metal and semiconductor, sorts semiconductor materials, transport effects in semiconductor material. Pass PN.
Semiconductor diode PN.
Bipolar transistors.
Thyristor and the others transswitch.
Homopolar transistors.
Optical electronic.
Display and screens.
Integrated Circuits.
Operating amplifier.
Other analog districts (voltage regulator tube and current , comparators, multivibrators).
Digital integrated circuits (TTL, STTL, ECL, CMOS).
Analog - Digital converters.
Digital - Analog converters.
Districts high integration.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Demonstrace, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* BOUŠEK, J. a kol. <I>Elektronické součástky</I>. VÚT Brno, 2005.
* Foit J., Hudec L. <I>Součástky moderní elektroniky, ČVUT Praha, 1998, ISBN 80-01-017893-3</I>.
* Vedral J., Fischer J. <I>Elektronické obvody pro měřicí techniku, ČVUT Praha , 2004, ISBN 80-01-02966-2</I>.

Course title	Construction of Electrical Equipments
Course code	KE/IKEZE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Vondra Radim, Ing. Ph.D.
* Hájek Martin, Ing.

Objective

The main scope of this study is to introduce actual technology and possibilities of how to design modern electronic devices. In this subject students will be informed about techniques and manufacturing processes of printed circuit boards (PCB), as well as assembly technology. Students will be informed about computer aided design systems and how they work. Primary task will be how to design printed circuit boards using design rules to perform product needs and electromagnetic compatibility requirements.
Students get knowledge about printed circuit boards. Especially how they are designed and manufactured including assembling technology of complex electronic devices. They will be informed about trends in CAD, CAM systems for electronics design & manufacturing process.

Prerequisities

Course contents

Preface, basic terminology.
CAD,CAE design systems for electronics, especially for designing printed circuit boards
Development of new electronic systems and devices. (design idea, schematic creation, PCB layout, prototyping, manufacturing, design verification).
Schematic design
- Creating schematic symbols, connections
- part name, net name, buses
- additional documentation (text, 2D lines, logos, etc.).

Printed circuit layout design
- package library
- net list
- technology requirements
- design strategy and verification.

Technologic data
- postprocessors (Gerber, Excellon)
- film matrices.

Basic electric properties of printed circuit boards
- resistor, capacity, inductivity, impedance, fast signals propagation
- calculating maximum current and voltage load level.
Electromagnetic compatibility
- interferences, electromagnetic field emission, design good PCB using EMC requirements.
Designing rules
- Component placement, elements and sectors
- supply voltage and power distribution, grounding issues,
- blocking power tracks, blocking and filtrating capacitors
- analog and digital design requirements
- galvanic isolation of inputs and outputs
- design rules for traces.
Documentation for manufacturing and assembling PCB
- manufacturing documentation, assembly drawings
- technologic.
Technology of manufacturing PCB
- basic materials (FR,CEM)
- variants of printed circuit boards
- manufacturing process of PCB boards (drilling, chemical and galvanic process)
- surface finish (solder mask, printing, chemical and galvanic)
- mechanical finish (cut, pressing, milling, V slotting techniques).
Measuring and testing quality of PCB
- quality process monitoring (analysis of defect)
- IPC,IEC, IEEE norms, technology and specification
- electric testers (flying probe, needle testers).
Assembly technology
- single double sided assembly
- classic THT technology (Through Hole Technology)
- SMT (Surface Mount Technology): BGA, UFP, CSP, COB, FLIP packages
- construction variants, packaging of basic substrates, etc.
- additional mechanical mounting: heat sinks, spec. connectors, etc.
Soldering technology
- hand soldering
- machine soldering process (heat and overflow)
- repairing strategy.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Demonstrace, Projekce, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška, Rozbor produktů pracovní činnosti studenta

Recommended reading

* Abel. <I>Plošné spoje se SMD, návrh a konstrukce, Platan,Pardubice 2000. ISBN 80-902733-2-7</I>.
* Starý, Šandera, Kahle. <I>Plošné spoje a povrchová montáž. Skriptum VUT, Brno 1999. ISBN 80-214-1499-5</I>.
* Šavel. <I>Materiály, technologie a výroba v elektronice a elektrotechnice, BEN, Praha 2004. ISBN 80-7300-154-3</I>.
* Tikkanen, H.:. <I>Printed Circuit Board Design Guide Using Modern CAD Systems: Examples Form PADS.</I>. Jyväskylä, 2004. ISBN 952-99423-0-3.
* Záhlava, V. <I>Metodika návrhu plošných spojů. Skriptum ČVUT, Praha 2000. ISBN 80-01-02193-9</I>.

Course title	Linear Electric Circuits
Course code	KE/ILEOE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Konečný Jiří, Ing. Ph.D.
* Fribert Miroslav, Ing. Dr.
* Kupka Libor, Ing. Ph.D.

Objective

The aim of the course Linear Electric Circuits is to add more detailed and basic knowledge of electricity to the knowledge gained from other courses, namely the course of basic electricity (theory of electricity).

After the study of this subject the student will have more deep knowledge of the fundamentals of electricity. Namely the student will be able to solve electric circuits with direct, alternating (sine-wave) and general form voltage and current sources, calculate electric power and work (energy) in one-phase and three-phase electric networks, will have a basic knowledge about two-ports, filters, etc.

Prerequisities

Course contents

Continuing in electricity theory. Electric current, electric voltage, electric power and work. Basic electric elements - resistor, capacitor, inductor, electric sources, diode, transistor.
Ohm's law, Kirchhoff 's laws, Thévenin theorem, Norton theorem, superposition.
Methods of electric circuit solution.
Main characteristics of electric elements - resistance, capacity , inductivity.
Resistance, capacity and inductivity of the elements connected in series and parallel.
Solving of the circuits with help of Thévenin and Norton theorems.
Systematic methods of electrical circuits solution - loop and mesh equations.
Alternating (sine-wave) voltages and currents in electric circuits, phasors and their using, impedance, laws for circuits.
Electric circuits with alternating voltage and current sources, power and work (energy) in such circuits.
Solving of electric circuits with general waveform voltage and current sources.
Solutions of the circuits with help of first order differential equations.
Solutions of the electric circuits with help oh higher order differential equations.
Using of Laplace transform for electric circuits solution.
Three-phase electric net. Power and work in the three-phase electric net.
Two-port networks, their y, z and other parameters, relationships between different type parameters, transfer function, input and output impedance.
Frequency filters, their types, parameters, realization.

Magnetic circuits, transfer lines.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Bezoušek, P., Schejbal, V. <I>Elektrotechnika. Pardubice: Univerzita Pardubice, 2002.</I>.
* Ďaďo S., Keidl M. <I>Senzory a měřicí obvody, ČVUT Praha, 1996</I>.
* Haňka L. <I>Teorie elektromagnetického pole, SNTL Praha, 1975</I>.
* Mikulec M., Havlíček V. <I>Základy teorie elektrických obvodů 1 a 2, ČVUT Praha, 1997/8</I>.
* Švec J. <I>Příručka automatizační a výpočetní techniky, SNTL Praha, 1975</I>.
* Vladař J., Zelenka J. <I>Elektrotechnika a silnoproudá elektrotechnika. SNTL Praha, Alfa</I>.

Course title	Electrical Engineering Material
Course code	KE/IMPEE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	4
Language	CZ

Name of lecturer

* Němec Zdeněk, Ing. Ph.D.
* Kvítek Emil, doc. Ing. CSc.
* Rozsíval Pavel, Ing.

Objective

The goal of this lectures is to introduce materials and basic products used at present time in electrotechnics, its properties and possibilities of exploitation.
After accomplishment of this lectures the student will get besic information about properties of materials used in modern ekectrotechnics and electronics. The students will also know where are these materials used, how to treat them and what is not allowed. In the consequntial studies the student will be understand the interpretation of described properties of these materials.

Prerequisities

Course contents

Properties of materials for electrical engineering and electronics, demandies and claims
Conducting materials for electricity, Cu and alloys
Al and alloys
Materials for resistors
Materials for elektric contacts and switching devices
Superconducting materials, examples of exploitation
Magnetics materials for permanent magnets and for pulse transformers
Magnetic alloys, ferities, all types
Nonconducting materials in form hard, liquid and gas
Materials for optoelectronic, source of light, opticfiber, possibilities of exploitation
Battery (primar and secundar type) and alternative electric sources, main properties
Printed circuit board, realisation
Recapitulation and preparation for exam

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Ústní zkouška

Recommended reading

* Rous B.:. <I>Materiály pro elektrotechniku a mikroelektroniku, SNTL 1991</I>.
* Šavel J.:. <I>Elektrotechnologie, BEN, 1999</I>.

Course title	Microprocessor Technology
Course code	KE/IMTEE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Novák Jaroslav, doc. Ing. CSc.
* Hájek Martin, Ing.
* Dobrovolný Martin, Ing. Ph.D.

Objective

This course provides students with the basic concepts of microcomputers, microprocessor architectures, low and high-level oriented programming of microprocessors and their applications, especially in embedded designs. Practical aspects are demonstrated on 8-bit architecture Atmel AVR.
Be able to apply any microprocessor, self-study of literature provided by manufacturers of microprocessors, assembler oriented programming of RISC microprocessors.

Prerequisities

Course contents

Basic terms: computer, microcomputer, CPU, bus. Introduction to semiconductor memories. Instructions. Computer architectures.
History of microprocessors. Microcontroller Unit (MCU). Atmel AVR architecture - The Core, memory map, addressing modes, move instructions.
Numbers in computers I. AVR - Arithmetic-logic unit (ALU), arithmetic instructions. working with signed numbers.
AVR - Logic instructions, bit-oriented operations. RISC vs. CISC CPU. Reset CPU. Instruction cycle.
CISC and RISC instruction cycle. Pipelining. AVR - branch instructions.
CPU stack. Subroutines. AVR - principles of peripherals and I/O devices.
Fixed-point, wide-byte arithmetics. BCD code - arithmetics operations, conversion from and to binary coded numbers.
Interrupts - basic principles, interrupt vector table, handlers, latency, priority, nested interrupts. MCU Interrupt logic. AVR interrupts - basics, external interrupt.
Serial data transfer - RS232, UART. AVR USART - description, programming techniques.
Numbers in computers II - fixed and floating point, fractional numbers. Floating point - radix scheme, arithmetic operations, IEEE 754 formats.
Introduction to programming AVR in C language - GCC compiler, extending over ANCI C (I/O operations, interrupts, combining C and assembler language).
Realization of mathematics functions - by lookup tables, square root, goniometric functions (Taylor series, CORDIC algorithm).
Computer buses - selection logic, address decoders, bus cycles, wait states, multiplexed buses
High performance concepts, trends in microcomputers architecture.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí

Assesment methods

Ústní zkouška, Posouzení zadané práce, Rozhovor

Recommended reading

* AVR Instruction Set reference manual. <I>dostupné online na http://atmel.com/atmel/acrobat/doc0856.pdf</I>.
* Katalogový list Atmel ATmega32. <I>dostupné online na http://atmel.com/dyn/resources/prod_documents/doc2503.pdf</I>.
* Mann, B. <I>C pro mikrokontroléry, BEN - technická literatura, Praha 2003, ISBN 80-7300-077-6</I>.
* Murdocca M., Heuring V. <I>Principles of computer architecture, Prentice Hall, 1999, ISBN-10: 0201436647</I>. Prentice Hall, 1999. ISBN 10: 0201436647.
* Pinker, J. <I>Mikroprocesory a mokropočítače</I>. Praha, BEN-technická literatura, 2004. ISBN 80-7300-110-1.
* PLUHÁČEK, A. <I>Projektování logiky počítačů</I>. ČVUT Praha, 2000.
* Váňa, V. <I>Mikrokontroléry Atmel AVR - assembler, BEN - technická literatura, Praha 2003, ISBN 80-7300-093-8</I>.
* Váňa, V. <I>Mikrokontroléry Atmel AVR - popis procesorů a instrukční soubor, BEN - technická literatura, Praha 2003, ISBN 80-7300-083-0</I>.

Course title	Electronis Circuits Analysis and Design
Course code	KE/INAOE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Konečný Jiří, Ing. Ph.D.
* Karamazov Simeon, prof. Ing. Dr.

Objective

This course follows Linear Electric Circuits and Computer Simulation of Electronic Circuits courses. The aim of the course (Analysis and Design of Electronic Circuits) is to prepare students for study of advanced analog and digital circuits, and to study the circuits on the boundary between analog and digital area. The emphasis is on analysis and design (synthesis) of electronic circuits.

After the study of this subject the student will be able to analyse electronic circuits characteristics and will be able to design electronic circuits with required electric characteristics (parameters). The emphasis is on circuit design.

Prerequisities

Course contents

Basic types of amplifiers - amplifiers with common emitter, common base, and common collector connections of transistor. Analysis and design of amplifiers with help of simplified equivalent circuits of transistor. Basic characteristics and parameters of these amplifiers. Analysis and design of amplifiers with help of computer simulation (SPICE).

Design of amplifiers with stable operation point (stable with change of temperature and with change of parameters of elements, namely parameters of transistors) .

Multistage amplifiers, amplifiers with feed-back coupling - frequency properties, stability. Transfer function of amplifier.

Various types of amplifiers - voltage amplifiers, current amplifiers, power amplifiers, narrow-band amplifiers , wide-band amplifiers.

Other analog circuits - amplitude and phase detectors, ring modulator, sample-and-hold circuits, limiters o hf signals, pulse amplifiers with resistive and inductive load, resonance amplifiers, oscillators, difference amplifiers, operational amplifiers. Flip-flops - bistable, monostable, and astable .

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* BIOLEK, D. <I>Řešíme elektronické obvody, Praha 2004, BEN</I>. BEN Praha, 2004. ISBN 80-7300-125-x.
* HOROWITZ, P., Hill, W. <I>The art of electronics, Cambridge, University Press, 1994</I>. University Press, Cambridge, 1994.
* NEUMANN, P., UHLÍŘ, J. <I>Elektronické obvody a funkční bloky I, II, ČVUT Praha, 1999 a 2001</I>. ČVUT Praha, 2001.
* PUNČOCHÁŘ, J. <I>Operační zesilovače v elektronice (5. vydání)</I>. BEN, Praha, 2002. ISBN 8073000598.

Course title	High speed circuits design
Course code	KE/INDOE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	4
Language	CZ

Name of lecturer

* Hájek Martin, Ing.
* Bezoušek Pavel, prof. Ing. CSc.

Objective

This course provides students with the concepts design of high speed digital circuits like motherboard of personal computers or circuits with programmable logic devices. One of main topics are rules for design of printed circuit boards (PCB). Questions of electromagnetic compatibility, signal integrity etc. are also discussed.
Ability of design high speed electronics systems, devices and PCBs.

Prerequisities

KE/INLOE

Course contents

Introduction to high speed design. Time ad frequency characteristics of digital signals.
Electromagnetic compatibility - EMI, RFI, ESD
Printed circuit board properties - impedance, resistance, capacity and inductance of tracks.
PCB as transmission line
Basics elements of PCB - wires, buses, vias, planes - impedances, influence to signal propagation throw PCB.
Design rules for high speed PCBs - crosstalk, signal reflections and their elimination techniques (impedance matching etc.)
Power supply distribution - filtration, blocking, connectors and cables.
Distribution clock signals. Oscillators for high speed circuits. Oscillator jitter.
Signal integrity, high speed PCBs measurements.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí

Assesment methods

Ústní zkouška, Posouzení zadané práce, Rozhovor

Recommended reading

* Brooks, D. <I>Signal Integrity Issues and Printed Circuit Board Design, Prentice Hall PTR; 1st edition, 2003, ISBN: 01-314-1884-X</I>.
* Johnson, H. <I>High-Speed Digital Design: A Handbook of Black Magic, rentice Hall PTR; 1st edition, 1993, ISBN: 01-339-5724-1</I>.
* Svačina, J. <I>Základy elektromagnetické kompatibility,VUT Brno, 2001.</I>. Brno: Vysoké učení technické, 2001.

Course title	Thesis
Course code	KE/INDPE
Type of course	Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	15
Language	CZ

Name of lecturer

* Němec Zdeněk, Ing. Ph.D.

Objective

The aim of course is drawing up Diploma thesis which is represented self-student's work under managing leader of work. Theme Diploma thesis is chosen by student from offering themes which are from branch of KRT.
After this course student is able to complete and hand the Bachelor Work according to requirements and by own choice theme.

Prerequisities

Course contents

Introduction - Choice appropriateness of Diploma thesis.
Requests to Diploma thesis.
Found out of data and information for Diploma thesis.
Work on Diploma thesis.
Consultation with chief of Diploma thesis and other authority and specialist
Consultation with chief of Diploma thesis and other authority and specialist
Hand in Diploma thesis.

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Posouzení zadané práce

Recommended reading

* <I>Podle pokynů vedoucího diplomové práce.</I>.

Course title	Thesis Tutorial
Course code	KE/INDSE
Type of course	Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	2
Language	CZ

Name of lecturer

* Němec Zdeněk, Ing. Ph.D.

Objective

The aim of course is to familiarize students with requests to Diploma thesis, its content and format style. Further it is recommended students the way for searching of necessary information, method of working out and preparing of Diploma thesis presentation with practice.
After this course student is able to complete Diploma thesis according to requirements, make technical and engineering documentation, and found out necessary information and data. Further student is able to present his work by appropriate form of document.

Prerequisities

Course contents

Introduction - requests to Diploma thesis.
Work methodology.
Structure and content of Diploma thesis; stages of Diploma thesis.
Consultation - subjects of final exam
Consultation - subjects of final exam
Format style of Diploma thesis
Presentation of document.
Presentation of preparing Diploma thesis.
Time reserve.

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Posouzení zadané práce

Recommended reading

* <I>Směrnice UPa a FEI</I>.

Course title	Electromagnetic Compatibility of Electronic Systems
Course code	KE/INEKE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	4
Language	CZ

Name of lecturer

* Fišer Ondřej, doc. Ing. CSc.

Objective

This topic should deepen the student's knowledge concerning electromagnetic compatibility (EMC) especially from the electronic system point of view. Enlargement of theoretical knowledge of electromagnetic fields, wave propagation through space and lines are emphasised.
The student is able to solve more sophisticated tasks of the interference signal transmission (through space as well as line) and derive pertinent formulas and work with spectral analysis.

Student takes bearing in the EMC field, differentiates interference sources as well as various ways of interference transmissions, he is able to suggest solutions to minimise the interferences. The student as also able to use the basic measurement methods of interference signal, he knows pertinent regulations.

Prerequisities

Course contents

Enlargement of knowledge of electromagnetic field (Maxwell equations, solutions in various medias, solution for harmonic response using phasors, description of medium from the radiowave propagation point of view.)
Propagation along long lines (line matching, Smith chart).
Propagation of radio-waves in space, multipath propagation, reflections and scattering of electromagnetic waves at boundary, real atmosphere influence on attenuation and phase delay of propagating radio wave, influence of terrain obstacles, Fresnel zones.
Basic antenna types, properties of antennas from the technical practice point of view.
Transformation of time and frequency domain (Fourier and Laplace transform), periodical signals, signal spectra, harmonic components, transient states.
Determination of the time domain response from the response in the frequency domain for linear circuits, non periodical and random signals, crosstalks and shielding.
Ultra wide band (UWB) and narrow band systems.
Digital circuits, spectrum analyzers.
Radiated emissions and susceptibility.
Guided emission and susceptibility.
Design of electronic circuits from the EMC point of view.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* BEZOUŠEK, P., SCHEJBAL, V., ŠEDIVÝ, P. <I>Elektrotechnika</I>. Univerzita Pardubice, 2008.
* Černohorský, D. a kol. <I>Elektromagnetické vlny a vedení. Brno: VUTIUM. 1999.</I>. VUTIUM, 1999.
* GREGORA, S., FIŠER, O. <I>Elektrotechnika (elektronická forma učebnice), Univerzita Pardubice, 2005.</I>.
* Mazánek, M., Pechač, P., Vokurka, J. <I>Antény a šíření vln. Vydavatelství ČVUT, 1999.</I>.
* Prokop, Vokurka. <I>Šíření elektromagnetických vln a antény. SNTL Praha, 1980.</I>. Praha, SNTL, 1980.
* SCHEJBAL, V. et al. <I>Elektrotechnika. Příklady</I>. Univerzita Pardubice, 2004. ISBN 80-7194-560-9.
* Svačina, J. <I>Elektromagnetická kompatibilita: principy a poznámky</I>. Brno, VUT, 2001.
* Svačina, J. <I>Základy elektromagnetické kompatibility,VUT Brno, 2001.</I>. Brno: Vysoké učení technické, 2001.
* Tysl, V., Růžička, V. <I>Teoretické základy mikrovlnné techniky. SNTL, Praha, 1989.</I>.
* Vondrák, M. <I>Elektromagnetická kompatibilita v teleinformatice: cvičení</I>. Praha, Vydavatelství ČVUT, 1998.
* Vrba, J. <I>Technika velmi vysokých frekvencí. Praha: ČVUT. 1998.</I>. ČVUT, 1998.

Course title	Design with Programmable Logic Devices
Course code	KE/INLOE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	4
Language	CZ

Name of lecturer

* Konečný Jiří, Ing. Ph.D.
* Marek Josef, Ing. CSc.

Objective

To acquaint students with basics of VHDL and PLD design.

Elementary knowledge from the field of VHDL and PLD.

Prerequisities

Course contents

Introduction, history of programmable logic devices (PLD).
Basic properties and types of PLD, architecture differencies.
Hardware description languages (HDL) survey: ABEL, VHDL,
Introduction to VHDL, hierarchical v. flat design.
Combinational logic function realization in VHDL, implementation
Sequential logic circuit description and realization, state machines.
Internal architecture of PLD, SPLD, CPLD, FPGA.
Design and testing tools, Altera, Xilinx, Lattice.
Configuration and testing of PLD, configuration device.
Intelectual property (IP) blocks and tools, Altera SOPC, NIOS.
Sample designs.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Kanilo, K. <I>VHDL for Programmable Logic</I>. Prentice Hall, New York, 1996.
* Kolouch, J. <I>Programovatelné logické obvody - cvičení, skriptum</I>. FEKT VUT Brno, 2002. ISBN 80-214-2197-5.
* Kolouch, J. <I>Programovatelné logické obvody - přednášky, skriptum</I>. FEKT VUT Brno, 2002. ISBN 80-214-2196-7.

Course title	null
Course code	KE/INMKE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	4
Language	CZ

Name of lecturer

* Němec Zdeněk, Ing. Ph.D.
* Bezoušek Pavel, prof. Ing. CSc.

Objective

The aim of the course is to acquaint students with principles and techniques of land mobile communications systems for transmission of telephone, data and multimedia signals and RFID systems. Deepen the understanding of theoretical knowledge gained in the study signals and systems and applying communication theory to practical application and develop knowledge of theories and techniques of communication systems.
Mobile communication

Prerequisities

Course contents

Overview of mobile systems: radio systems, mobile telephone systems, satellite mobile telephone systems.
Radio stations and radio networks - frequency bands and their characteristics, the radio block structure, and its parameters, types of radio service, radio network systems, their properties and characteristics, methods of mass approach.
Mobile telephony - cellular systems, principles and description of GSM first and second generation, frequency and time division multiplexing, modulation, channel coding and interleaving, equalization, logical and operational structure of the channel functions in establishing, cancellation and transfer connections. Block structure basis-station and mobile station. Higher-generation mobile systems, UMTS. Comparison with other systems, mobile telephony.
Radio data transmission systems, broadband systems for a short distance, their principles and characteristics, problems and promising applications.
RFID - principles, types and parameters of passive and active chips, used methods of modulation and signals, the method of activation, reading, security transfer. Readers, their block structure, characteristics and parameters.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Demonstrace

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Doboš, L. a kol. <I>Mobilné rádiové siete, 1. vyd.</I>. Žilina, Žilinská univerzita, 2002. ISBN 80-7100-936-9.
* Hanus, B. <I>Bezdrátové a mobilní komuinikace. Skripta FEKT VUT.</I>. Brno, 2003. ISBN 80-214-1833-8.
* Mehrotra, A. <I>GSM System Engineering. Artech House.</I>. Boston London, 1997.
* Redl, S. M., Weber, M. K., Oliphant, M. W. <I>An Introduction to GSM . Artech House.</I>. Boston London, 1995.
* Walker, J. <I>Mobile Information Systems. Artech House.</I>. Boston London, 1990.

Course title	Transmission and Processing of Video and Audio Signals
Course code	KE/INMSE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	4
Language	CZ

Name of lecturer

* Bezoušek Pavel, prof. Ing. CSc.
* Dobrovolný Martin, Ing. Ph.D.

Objective

The course provides to students essential knowledge of data transmission theory and the principles of transmission and processing of audio and video signals. The understanding of these principles is necessary for the next study of communications systems in the next semesters.
After the course will student have the knowledges from the transmission and processing of audio and video signals area. The understanding of these principles is necessary for the next study of communications systems in the next semesters.

Prerequisities

Course contents

The principle and the techniques of video and audio signals capturing.
The analogue systems of transmission of picture signal: the frequency band requirements, the signal pre-processing, the transmission of video signals (composite video signal, TV fields...)
The digital image transmission systems: HDTV, the picture signal pre-processing techniques (the image compression ? lossless, the JPEG/MPEG/JPEG2000 principles, the codec suitable for streaming video broadcasting).
The digital audio transmission systems: the VoIP systems, the multicast broadcasting, the multimedia purpose of the IPv6 protocol.
The compression of audio signals (ulaw, the audio codecs, the compression in GSM systems). the processing of audio signals: MPEG-Audio, MUSICAM, ATRAC, DOLBY. The coding and compression of audio bit stream. The psychoacoustic model.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Laborování

Assesment methods

Ústní zkouška, Posouzení zadané práce

Recommended reading

* Castelman, K.R. <I>Digital Image Processing</I>.
* KEITH, J. <I>Video Demystified</I>. LLH Technology Publishing, Eagle Rock, USA, 2001.
* Klíma, M. a kol. <I>Zpracování obrazové informace</I>. Praha: FEL ČVUT, 1996. ISBN 80-01-01436-3.
* PRCHAL, J., ŠIMÁK, B. <I>Digitální zpracování signálů v telekomunikacích</I>. ČVUT Praha, 2000.

Course title	Advanced Analogue Circuits
Course code	KE/INPAE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS+LS
Number of credits	6
Language	CZ

Name of lecturer

* Konečný Jiří, Ing. Ph.D.
* Karamazov Simeon, prof. Ing. Dr.

Objective

The aim of the course Advanced Analog Circuits is to acquaint the students with principles and design of analog circuits and larger function blocks which are parts of modern communication, control, and signal processing equipments.

After the study of this subject the student will know functioning, characteristics and usage of complex circuit blocks of communication, control and signal processing equipments.

Prerequisities

Course contents

Basic means for analog circuit analysis - transfer function for small and high level signals, input and output impedances, noise and distortion analysis.
Characteristics (properties) of the basic passive and active circuit elements on higher frequencies.
Analog filters - types, synthesis, frequency and impedance scaling and transformation.
Analog filters - realization (implementation) with R, L, C elements, active filters with operational amplifiers (OpAmps).
Low noise circuits - principles, ideas (concepts), low noise OpAmps.

A/D and D/A converters - types, characteristics, using, measuring of parameters.
Circuit design of the boundary circuits between analog and digital parts of A/D and D/A converters - filters, level shifting circuits, input safeguarding. Choice of OpAmps for converters - important parameters. Voltage references.
Oscillators - requirements, specifications, parameters, design. Oscillators with Transistors, VCO, TXCO.
Phase-lock loop (PLL) - block scheme, mathematic analysis, phase noise, problems with synchronization (locking), usage.
Switching power supply sources - principles, design with help of modern control integrated circuits (IC).

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* PUNČOCHÁŘ, J. <I>Operační zesilovače v elektronice (5. vydání)</I>. BEN, Praha, 2002. ISBN 8073000598.
* Tietze, U., Schenk, Ch. <I>Electronic circuits - Design and applications</I>. Springer, London, 1999. ISBN 3540004297.
* Williams, J. <I>The Art and Science of Analog Circuit Design</I>. Newnes, 1998. ISBN 750670622.

Course title	3D Computer Graphics and the Graphic API
Course code	KE/INPG3
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Fribert Miroslav, Ing. Dr.
* Kopecký Zbyněk, Ing.

Objective

The aim of the course is to acquaint the students with necessary knowledge of the three-dimensional computer graphic algorithms.
Student should understand method s of the description three-dimensional curves and surfaces, methods of modelling 3D graphic object, their displayed on 2D output device and process animation of these objects. Students should acquire application of modern programme 3D computer graphic and computer animation creation.

Students should acquire the theoretic model of creation 3D graphic object and skills to use and work with modern computerized programs for visualization and animation.

Prerequisities

Course contents

Mathematical basic 3D graphic - basic relations of vector arithmetic, basic relations from three-dimensional analytic geometry.
Modelling 3D object - modelling curves, modelling surface, modelling solid.
Imaging three -dimensional object.
Visualization, animation and virtual reality.
Program Autodesk 3ds Max, Autodesk Maya.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Nácvik dovedností

Assesment methods

Ústní zkouška, Posouzení zadané práce

Recommended reading

* Forsyth D., A., Ponce J. <I>Computer Vision - a modern Approach</I>. Prentice Hall, 2002.
* Watt, A. <I>3D Computer Graphic</I>. Addisson-Wesley, 2000.
* Žára J. a kol. <I>Moderní počítačová grafika. Computer Press</I>. Brno. ISBN 80-251-0454-0.

Course title	Transmission Networks
Course code	KE/INPRS
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Štěpánek Ladislav, Ing.
* Bezoušek Pavel, prof. Ing. CSc.

Objective

The goal of the subject is to inform the attendants about the principles of data-transmission through access and backbone network technology (communication lines, parameters of metallic and optical transmission paths, mobile communications).
Graduates of subject get a universal view about the conception of basic cable and wireless communication systems. He/She will be informed about its structure and function as well as methods of manipulation and transmission signal.

Prerequisities

Course contents

Basic of data communications (classical copper and optical cable, radio communication).
Speed, retardion, bandwith , data asynchronous and synchronous transmission.
Transmission equipments and network architecture (local and extensive network).
Network topology, reports TCP/IP.
PDH (Plesiochronous Digital Hierarchy), SDH (Synchronous Digital Hierarchy), DWDM (Dense Wavelength Division Multiplexing), CWDM (Coarse Wavelength Division Multiplexing), ATM (Asynchronous Transfer Mode).
Technology xDSL (Digital Subscrieber Line - ADSL,HDSl,VDSL).
Cable networks HFC (Hybrid Fiber Coax), DOCSIS (Data-over-Cable Service Interface Specification).
Laser and microwawe communication.
Wireles communications - WiFi (Wireless Fidelity), WiMAX (Worldwide Interoperability for Microwave Access Forum).
Optical network - PON (Passive Optical Network APON, EPON, GPON), AON (Active Optical Network), WDM (wavelength-division multiplexing).
ISDN Technology.
Mobile technology CDPD (Cellular Digital Oacket Data), HSCD (High Speed Circuit-Switched Data), GPRS (General Packet Radio Service), EDGE (Enhanced data for GSM Evolution).
Satelite transmission - VSAT (Very Small Aperture Terminal), GEO (Geosynchronous Earth Orbit), LEO (Low Earth Orbit).
Home wireles communications - RF (Radio Frequency), IR (Infra Red), WPAN Wireles Personal Area Networks).

Teaching methods

Monologická (výklad, přednáška, instruktáž), Demonstrace, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* <I>Doporučení ITU - T, ETSI a ATM Fóra</I>.
* Blunár, Diviš. <I>Telekomunikační sítě - 1. díl. VŠB - TU Ostrava, 2003</I>.
* GŘS - Vzdělávací centrum, SPT Telecom, a.s. <I>Telekomunikační výukové programy</I>. Brno, 1999.
* Pužmanová, R. <I>Širokopásmový Internet - Přístupové a domácí sítě</I>. Praha, 2004. ISBN 80-251-0139-8.
* SVOBODA, J. a kol. <I>Telekomunikační technika Díl 1-3</I>. Hüthig & Beneš - Nakladatelství Sdělovací technika, 2000.
* Škorpil, Gregořica. <I>Vysokorychlostní komunikační systémy</I>. VUT, 2004.
* Vodrážka, Pravda. <I>Principy telekomunikačních systémů. ČVUT, 2006</I>.
* Vodrážka. <I>Přenosové systémy v přístupové síti. ČVUT, 2006</I>.

Course title	Radio-Communication Systems Technology
Course code	KE/INRKE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	4
Language	CZ

Name of lecturer

* Bezoušek Pavel, prof. Ing. CSc.
* Schejbal Vladimír, prof. Ing. CSc.
* Závodný Vadim, Ing.

Objective

The aim of the subject is to provide students with basics of radiocommunication technology to support their further study of signal transport and processing in communication and process control. The subject links to communication technology subjects of the bachalar study program.
Student will get an insight in radiocommunication system problems and practical experience in application of modulation methods, demodulation and detection of communication signals.

Prerequisities

Course contents

Electromagnetic wave propagation and antennas of radiocommunication devices:
Spherical and plane waves, propagation along the Earth surface, atmospherical and ionospherical refractions, wave difraction, atmospherical loss.
Antennas and their characteristics, quarter-wave and half-wave antennas, reflector antennas, phased arrays.
EHF circuits:
Homogenous lines and their characteristics, impedance on the homogenous line, Smith diagram, homogenous line sections and their junctions, coupled lines.
Scatterig parameters of RF circuits, distributed parameters circuits, basic types of linear circuits with distributed parameters (half-wave resonator, impedance transformer, RF choke, power divider, directive coupler, hybrid and magic Tee).
Radio transmitters and receivers:
Homodyne and heterodyne receivers, frequency diagram of the receiver, dynamic characteristics of the receiver, linear and non-linear distorsion corrections, digital receiver and its characteristics.
EHF high power transmitters, valve - based transmitters, high power tranzistor transmitters. Block diagram of T/R modules, duplexer, local oscillators, coherence, carrier regeneration.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Demonstrace, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* MAZÁNEK, M., PECHAČ, P. <I>Šíření elektromagnetických vln a antény</I>. ČVUT Praha, 2004.
* POZAR, D.M. <I>Microwave engineering</I>. Hoboken: John Wiley and Sons, 2005.
* SYROVÁTKA, B. <I>Radiové prijímače a vysílače</I>. ČVUT Praha, 2005.

Course title	Annual Project
Course code	KE/INRPE
Type of course	Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	4
Language	CZ

Name of lecturer

* Němec Zdeněk, Ing. Ph.D.

Objective

The aim of course is process self-student's work, theme is chosen by student from offer of KE.

After this course student is able to complete Year Project according to requirements, to make technical and engineering documentation, and to find out necessary information and data. Further student is able to present his work by appropriate form of document.

Prerequisities

Course contents

Introduction - Theme choice by student, work methodology.
Find out and make up and structure of document for Year Project I.
Own work and labor on Year Project I.
Discussion with chief of project
Own work and labor on Year Project I.
Submission of Year project I
Time reserve and other information.

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Posouzení zadané práce

Recommended reading

* <I>dle zadání projektu</I>.

Course title	Electronic Systems Dependability and Safety
Course code	KE/INSBE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Filip Aleš, doc. Ing. CSc.

Objective

Dle specifikace garanta předmětu.

Dle specifikace garanta předmětu.

Prerequisities

Course contents

Dle specifikace garanta předmětu.

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Ústní zkouška

Recommended reading

* ČSN EN 50 159-1,2. <I>Drážní zařízení - Sdělovací a zabezpečovací systémy a systémy zpracování dat - Komunikace v uzavřených a v otevřených přenosových zabezpečovacích systémech</I>. 2002.
* ČSN EN 61 508. <I>Funkční bezpečnost elektrických (elektronických) programovatelných systémů související s bezpečností</I>. 2002.

Course title	Digital Signal Processors
Course code	KE/INSPE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	4
Language	CZ

Name of lecturer

* Novák Jaroslav, doc. Ing. CSc.
* Hájek Martin, Ing.

Objective

The goal of this course is to inform students about up to date possibilities of realization algorithms of digital signal processing on digital signal processors (DSP). In the progress of course, attention is paid to correct and efficient implementation algorithms of digital filtration, FFT, correlation, etc. DSP's architecture specifics are also discussed. Students work with development kits with SHARC DSPs from Analog Devices during labs.
Knowledge of architecture of Digital signal processors, implementation and optimalization of signal processing task into DSP hardware from Analog Devices in assembler and C language.

Prerequisities

KE/INLOE

Course contents

From algorithms to DSP architecture, categories of DSPs.
Computational units of DSP. Analog Devices SHARC processors.
DSP program and data memories, addressing modes, principles of direct memory addressing.
SHARC instruction set.
Floating and fixed point numbers and calculation, computational errors.
Connecting DSP to A/D and D/A converters. Booting process and initialization of DSP.
Representation of data with finite word length. Effect of quantization to signal processing.
Implementation of FIR filters.
Implementation of IIR filters.
Basics operations.
Basic operations of FFT algorithm.
FFT - preparing the computation, possibilities of operation savings.
Computation of cyclic convolution, filtration in frequency domain.
Examples of DSP application: audio signal processing, radars.
Modern trends in DSP: VLIW, common architecture's CPU in signal processing application.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí

Assesment methods

Ústní zkouška, Posouzení zadané práce, Rozhovor

Recommended reading

* Kuo, S.M. <I>Real-Time Digital Signal Processing</I>. John Wiley, 2006.
* Skalický, P. <I>Aplikace signálových procesorů - cvičení</I>. Vydavatelství ČVUT, Praha, 2003.

* Skalický, P. <I>Aplikace signálových procesorů.</I>. Vydavatelství ČVUT, Praha, 2003. ISBN 80-01-02647-7.
* Skalický, P. <I>Číslicové systémy v radiotechnice</I>. Vydavatelství ČVUT, Praha, 2004.

Course title	Signals and Systems
Course code	KE/INSSE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Bezoušek Pavel, prof. Ing. CSc.
* Závodný Vadim, Ing.

Objective

The aim of the subject is to provide students with teoretical backgrounds of signals and systems needed for the further study of signal processing in communication and control. The subject links to basic knowledge of signals, electronic circuits and modulations gained during the bachalor study.
Student will get basics in theory of the determined and random signals and in linear systems both in the continuous and discrete time needed for the further study of the signal transfer and processing in communication and control.

Prerequisities

Course contents

Signal classification: Peridical signals, non-periodical signals, causal and non-causal signals, signals in the continuous and discrete time.
Basic signal characteristics: mean value, power, energy, correlation function.
Spectral representation of signals: Fourier series, Fourier transform, DTFT, DFT.
Selected signals examples: Rectangular pulse, Diraque pulse, unity step pulse.
Bandpass signals: Hilbert transform, envelope, phase, frequency, complex envelope, bandpass signal sampling.
Continuous time systems: Classification, LS systems, frequency domain and time domain representation, stability and causality, output signal characteristics.
Discrete time systems: Classification, difference eqations, Z. transform, LS systems characteristics in the time and frequency domain. Stability and causality, output signal characteristics.
Random signals: Random signals description and characteristics, staionary and ergodic signals, cyclostationary components of the random signals, autocorelation function and the power spectra, random signals in LTI systems.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* F. Vejražka. <I>Signály a soustavy, ČVUT Praha, 1995</I>. ČVUT.
* HRDINA, Z., VEJRAŽKA, F. <I>Signály a soustavy, ČVUT Praha, 1998</I>. ČVUT Praha, 1998.

* TAYLOR, J.F. <I>Principles of Signals and Systems</I>. McGraw-Hill, Inc., 1994. ISBN 0-07-911171-8.

Course title	Theory of Communication
Course code	KE/INTSE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Bezoušek Pavel, prof. Ing. CSc.
* Závodný Vadim, Ing.

Objective

The subject aim is to providee students with a theoretical base needed for understanding and further study of communication systems and subjects, dealing with signal processing in communication and control systems.
Student will get an insight in modulation, demodulation and detection methods used in communication needed for the further study of signal transport and proccessing in communication.

Prerequisities

Course contents

Signals in communication: Summary, Orthogonal base signal decomposition. Bandpass random signals.
Communication channel and its architecture: Modulation, source and channel coding, synchronisation and equalisation.
Modulators: linearity, stationarity, structure - the discrete and expansion parts.
Modulation: linear memoryless modulation, modulation with memory, non-linear modulation, PAM, ASK, PSK, QAM, FSK
Communication channel characteristics, channel operator, time dependence, linearity.
Channel basic models: additive chan. with the Gauss noise, linear non-selective and selective chan., nonlinear chan., random channel.
Spread spectrum communication, multicarrier communication.
Multiplex and bulk access systems.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Couch, L.W. <I>Digital and analog communication systems, 2001</I>.
* J. Proakis. <I>Digital Communication, 1996</I>. Mc Graw Hill Inc, 2002.
* Sýkora, J. <I>Teorie digitální komunice, 2005</I>.

Course title	Radio Positioning Systems
Course code	KE/INUPE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	4
Language	CZ

Name of lecturer

* Závodný Vadim, Ing.
* Filip Aleš, doc. Ing. CSc.
* Bezoušek Pavel, prof. Ing. CSc.

Objective

The subject aim is to explain principles and methods of position and velocity determination using radiowaves and provide a deep insight of signal processing methods, used mainly in satelite navigation systems (GNSS) and radars. Student will get an insight in methods of position and velocity evaluation using radio waves, he will be aquainted with technology of signal processing, used mainly in satelite navigation and radar systems.

Prerequisities

Course contents

General formulation of generalized object position estimation. Principles of radiopositioning, characteristics of the time-of-arrival, dirrection-of-arrival, phase-measurement and doppler systems and their combinations.
An overview of satelite navigation systems (GNSS) and their characteristics, description of GNSS: NAVSTAR and GALLILEO, the main characteristics, the measure of effectivity, safety, reliability and integrity of positionning systems from the point of view of the Air Traffic Control. Local elements architecture, services with guaranted accuracy, reliability and safety.
Primary, secondary and passive radars:Measurement methods of range, angle and velocity of objects in radars, measurement umbiguity, resolution and accuracy.
Radar signal characteristics, signal scattered by objects, the effect of environment, radar equations. Primary radar classification, structure, regimmes.
Radar subsystems: Antennas and RF parts, trnasmitter/receiver, signal processor, data processor.
Secondary radars and passive radars.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Demonstrace, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Bezoušek, P., Šedivý, P. <I>Radarová technika</I>. ČVUT Praha, 2004.
* Hrdina, Z., Pánek, P., Vejražka, F. <I>Rádiové určování polohy</I>. ČVUT Praha, 1995.

Course title	Fundamentals of Multimedia Technology
Course code	KE/INZMT
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Fribert Miroslav, Ing. Dr.
* Kopecký Zbyněk, Ing.
* Ševčík Pavel, Mgr.

Objective

The course provides to students essential knowledge of multimedia processing and multimedia applications building. The practical training is mainly on the multimedia author´s systems focused.
During the course students acquire the basic knowledge and skills within the multimedia author´s systems and the of the multimedia presentation creation skills.

Prerequisities

Course contents

The introduction to the multimedia (basics terms, historical context, basic components, development tools, the multimedia products area)
Technology and resources suitable for multimedia (the computer requirements, communication network, development tools)
Video processing (video digitalization, video standards, the introduction to the video compression, commonly video files formats, QuickTime, video processing and utilization)
Animation processing (sprite and key-frame animations, 3D animations)
Audio processing (audio capturing, audio compression, commonly audio files formats, audio and video fusion)
The multimedia product building (hypertext, synchronized multimedia)
The multimedia interactivity (events oriented control, the multimedia objects behavior, script languages, time-line scripts)
Multimedia and computers networks (communication networks and protocols, network and transport protocols, multicasting, multimedia protocols in the application layer)

Teaching methods

Monologická (výklad, přednáška, instruktáž), Nácvik dovedností, Laborování

Assesment methods

Ústní zkouška, Posouzení zadané práce

Recommended reading

* Chapmann, N., Chapmann, J. <I>Digital Media Tools</I>. John Wiley a Sons, Chichester, 2007. ISBN 978-0-470-01227-7.
* Chapmann, N., Chapmann, J. <I>Digital Multimedia</I>. John Wiely a Sons, Chichester, 2001. ISBN 0-471-98386-1.

* Furth, B., Milenkovic, M. <I>A Guided Tour od Multimedia System and Aplikations</I>. IEEE Computer Society Press, 1995. ISBN 0-8186-7054-1.

Course title	Image Processing
Course code	KE/INZO
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Fribert Miroslav, Ing. Dr.

Objective

The aim of the subject is the understanding of image processing fundamentals and familiarizing with technologies used in this realm (image digitalization, image transformation, image preprocessing, image restoration etc.). Further is it understanding of the objects features evaluation included in the image.

Ability of using of theoretical models in image processing applications

Prerequisities

Course contents

Introduction to image processing: Basic features of raster image. Sampling of 2D image. Linear image processing. Fundamental equation of linear image processing.
Linear image transformations: 2D Fourier transform. Walsh-Hadamard transform. Cosine transform. Haar and Vawelet transform. Elementary images of linear image transformations.
Statistical descriptions of images: Image as a random field. Statistical characteristics of the random field. Ergodicity of the random field. Karhunen-Loeve transform.
Image preprocessing: Brightness scale transform. Equalization of the histogram. Geometric transform and interpolation. Filtering in the frequency space. Filtering in the space area. Nonlinear preprocessing.
Image restoration problem: Simple degradations of image. Inverse filtering. Wiener restoration filter.

Image segmentation: Thresholding. Region growing. Edge detection and edge operators. Image sharpening. Objects classification in images.
Measurement in images: Brightness and color measurement. Measurement of feature size. Describing shape and distortion measurement. Determining location and orientation.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Nácvik dovedností

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Forsyth, D. A., Ponce, J. <I>Computer Vision - a Modern Approach</I>. Prentice Hall, 1 .vydání, 2002. ISBN 0-13-085198-1.
* Fribert, M. <I>Základy zpracování obrazu, ISBN 80-7194-901-9</I>. Skriptum Univerzita Pardubice, 2006. ISBN 80-7194-901-9.
* Hlaváč, V., Šonka, M. <I>Počítačové vidění, ISBN 80-85424-67-3</I>. Praha: Grada, 1992. ISBN 80-85424-67-3.
* Klíma, M. a kol. <I>Zpracování obrazové informace</I>. Praha: FEL ČVUT, 1996. ISBN 80-01-01436-3.
* Martišek, D. <I>Matematické principy grafických systémů</I>. Littera, 2002. ISBN 80-85763-19-2.
* Pratt, W. K. <I>Digital Image Processing, ISBN: 0-471-37407-5</I>. New York, USA: John Willey & Sons, INC., 2001. ISBN 0-471-37407-5.
* Sonka, M., Hlavac, V., Boyle, R. <I>Image Processing, Analysis and Machine Vision, ISBN 0-412-45570-6</I>. London: Chapman & Hall, 1995. ISBN 0-412-45570-6.
* Žára, J., Beneš, B., Felkel, P. <I>Moderní počítačová grafika</I>. Praha: Computer Press, 1998. ISBN 80-7226-049-9.

Course title	Image Processing
Course code	KE/INZOE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	4
Language	CZ

Name of lecturer

* Fribert Miroslav, Ing. Dr.
* Dobrovolný Martin, Ing. Ph.D.

Objective

The aim of the subject is the understanding of image processing fundamentals and familiarizing with technologies used in this realm (image digitalization, image transformation, image preprocessing, image restoration etc.). Further is it understanding of the objects features evaluation included in the image.

Ability of using of theoretical models in image processing applications

Prerequisities

Course contents

Introduction to image processing: Basic features of raster image. Sampling of 2D image. Linear image processing. Fundamental equation of linear image processing.
Linear image transformations: 2D Fourier transform. Walsh-Hadamard transform. Cosine transform. Haar and Vawelet transform. Elementary images of linear image transformations.
Statistical descriptions of images: Image as a random field. Statistical characteristics of the random field. Ergodicity of the random field. Karhunen-Loeve transform.
Image preprocessing: Brightness scale transform. Equalization of the histogram. Geometric transform and interpolation. Filtering in the frequency space. Filtering in the space area. Nonlinear preprocessing.
Image restoration problem: Simple degradations of image. Inverse filtering. Wiener restoration filter.

Image segmentation: Thresholding. Region growing. Edge detection and edge operators. Image sharpening. Objects classification in images.
Measurement in images: Brightness and color measurement. Measurement of feature size. Describing shape and distortion measurement. Determining location and orientation.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Nácvik dovedností

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Forsyth, D. A., Ponce, J. <I>Computer Vision - a Modern Approach</I>. Prentice Hall, 1 .vydání, 2002. ISBN 0-13-085198-1.
* Fribert, M. <I>Základy zpracování obrazu, ISBN 80-7194-901-9</I>. Skriptum Univerzita Pardubice, 2006. ISBN 80-7194-901-9.
* Hlaváč, V., Šonka, M. <I>Počítačové vidění, ISBN 80-85424-67-3</I>. Praha: Grada, 1992. ISBN 80-85424-67-3.
* Klíma, M. a kol. <I>Zpracování obrazové informace</I>. Praha: FEL ČVUT, 1996. ISBN 80-01-01436-3.
* Martišek, D. <I>Matematické principy grafických systémů</I>. Littera, 2002. ISBN 80-85763-19-2.
* Pratt, W. K. <I>Digital Image Processing, ISBN: 0-471-37407-5</I>. New York, USA: John Willey & Sons, INC., 2001. ISBN 0-471-37407-5.
* Sonka, M., Hlavac, V., Boyle, R. <I>Image Processing, Analysis and Machine Vision, ISBN 0-412-45570-6</I>. London: Chapman & Hall, 1995. ISBN 0-412-45570-6.
* Žára, J., Beneš, B., Felkel, P. <I>Moderní počítačová grafika</I>. Praha: Computer Press, 1998. ISBN 80-7226-049-9.

Course title	Digital Signal Processing
Course code	KE/INZSE
Type of course	Lecture + Lesson
Level of course	Mgr.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Konečný Jiří, Ing. Ph.D.

Objective

This subject (Digital Signal Processing - master study) follows the subject with the same name from bachelor degree study. The aim of this course is to give to students more deep and thorough knowledge about digital signal processing. It serves as a theoretic base for another subjects.

Through the study of this subject student acquires more deep knowledge about digital signal processing - using of DFT, Z-transform, design of filters. Student will be able to use this knowledge for design of concrete equipments for signal processing.

Prerequisities

Course contents

Introduction - a short survey of A/D and D/A converters, sampling in time and quantization in amplitude, coding. Block diagram of analog signal discrete processing. Sample rate reduction and increase by an integer factor.
Digital system analysis in the image (transform) area. Transfer function in the Z-transform, connection with convolution in the time area, stability, causality, responses of the digital system to some input signals. Systems with linear phase, recursive and nonrecursive digital systems.

Discrete Fourier Transform (DFT) and its implementation with fast Fourier transform (FFT), using of FFT.
Digital filters and their implementation with finite impulse response (FIR) and infinite impulse response (IIR) systems. Implementation in time domain, canonic forms of implementation, effects of the finite word length, quantization of the coefficients, round-off noise.
Parameters of the filters, implementation of the FIR filters with help of weighting window, implementation of the IIR filters with help of analog transfer function - bilinear and other transforms. (Butterworth, Tchebyshev, elliptic filters.)
Digital Processing of random signals.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Davídek, V., Pšenička, B. <I>Prostředky diskrétního zpracování signálů</I>. ČVUT.
* Davídek, V., Sovka, P. <I>Číslicové zpracování signálu a implementace</I>. ČVUT.
* PRCHAL, J., ŠIMÁK, B. <I>Digitální zpracování signálů v telekomunikacích</I>. ČVUT Praha, 2000.
* Uhlíř, J., Sovka, P. <I>Číslicové zpracování signálu</I>. ČVUT.

Course title	Data Transmission
Course code	KE/IPDAE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	4
Language	CZ

Name of lecturer

* Němec Zdeněk, Ing. Ph.D.
* Pidanič Jan, Ing.

Objective

The course provides to students essential knowledge of data tranmission through transmission lines and associated linear distortion effects. The students should acquire the main principles in pulse modulation, source coding, channel coding, data modems and data transmission services.
The students acquire theoretical and practise knowledge and skills of data tranmission through metallic transmission lines, data codding and pulse modulation.

Prerequisities

Course contents

Standards for information and communication technologies,
Fundamental terms - data, transmission capacity. Data transmission and evaluation.
Signal types. Time and frequency domain of signal.
Homogeneous line, RLCG transmission line.
Transmission channels - aerial lines, cables, optical fibre,
Metallic transmission lines.
Digital signal modulation.
Pulse modulation, delta modulation, pulse code modulation.
Source coding, channel coding.
Synchronous and asynchronous data transmission. Multiplex transmission.
End user device, modems.
Data networks, OSI Reference Model.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Demonstrace, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Svoboda J. a kol. <I>Telekomunikační technika, Díl 1, Hüthig a Beneš, Praha 1999, ISBN 80-901936-3-3</I>.
* Šimák B., Svoboda J. <I>Základy teleinformatiky, skripta ČVUT Praha, 1996</I>.

Course title	Programming in C Language
Course code	KE/IPJCE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	3
Language	CZ

Name of lecturer

* Dušek František, doc. Ing. CSc.
* Hájek Martin, Ing.

Objective

This course is focused to teach students to write programs in C language. It covers all aspects of programming in this language - pointers, memory management, modular programming etc. During course students will work with Microsoft Visual Studio and free GNU Tool chain GCC).

By the end of the course, students will know how to write a significant program in C.

Prerequisities

KE/IAZPE

Course contents

Introduction to C language, first program, comments, keywords, data types.
Variables definition, operators, assignment, type conversion, ternary operator.
Control structures.
Pointers, (static) arrays.
Functions - definition, calling by value and reference, pointers to funtions.
Memory management.
Chars, Strings, Structures, Unions, Bit arrays, Enumenrations.
Preprocessor.
Standard library I.
Standard library II.
Modular programming.
GNU Tool chain - GCC, make utility.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí

Assesment methods

Ústní zkouška, Posouzení zadané práce, Rozhovor

Recommended reading

* Eckel, B. <I>Myslíme v jazyku C++, Grada Publishing, Praha 2000, ISBN 80-247-9009-2</I>.
* Eckel, B. <I>Myslíme v jazyku C++ 2.díl - knihovna zkušeného programátora, Grada Publishing, Praha 2005, 80-247-1015-3</I>.
* Herbison, S.P., Steele, G.L. <I>Referenční příručka jazyka C.</I>. Science, 1996.
* Herout, P. <I>Učebnice jazyka C - 2. díl. IV. přepracované vydání.</I>. KOPP, 2004.
* Herout P. <I>Učebnice jazyka C, Nakladatelství KOPP, 2004, IV. přepracované vydání</I>.

Course title	Computer Networks
Course code	KE/IPOSE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Kavička Antonín, doc. Ing. Ph.D.
* Dobrovolný Martin, Ing. Ph.D.

Objective

The course provides to students essential knowledge of data transmission theory. The course content is an overview of the basic computer networks knowledges and the main network technologies.
The basic knowledges from computer network area (especially from LAN networks). The student will be able independently and actively solve the dis-functionality of computer networks mainly on 2nd and 3th level.

Prerequisities

Course contents

Introduction:
the computer network (CN) purpose. the CN taxonomy, the general model of CN architecture, the referential model, the CN elements.
Physical layer:
The main properties of the communication path, the modulation techniques, the basic and broad band, the serial and parallel data transmission, the differential and asymmetric signal, the synchronous and asynchronous signal, the practicular realisation on physical layer: RS232, Ethernet, The structured cabling, Blue tooth, Wireless Networks.
The link layer:
The shared medium access, the link-layer addressing. the main link protocols, the Ethernet frame.
Network layer:
IP protocol, IP addresses and masks, ICMP, the packet fragmentation, AGRP, IGMP, The active elements of 3th level.
Transport layer:
TCP a UDP protocols, the CN routing techniques and routing protocols.
The routing principles, the routing tables, direct and indirect routing, the routing algorithms, the main routing protocols:

RIP, IGRP, E-IGRP, OSPF, EGP, BGP, the access lists.
Application layer:
The function of the application layer, some of the application layer protocols: Telnet, FTP, T-FTP, NFS, SSH and others.
IPv6.
The solutions techniques for decrescent address space problem in IPv4, IPv6 ? new properties, the IPv6 structure, the encryption and authentications methods, the address space and the address representation, the unambiguous addresses, the auto configuration, the modern operation systems IPv6 support.
System DNS
Wireless networks:
The wireless networks made by 802.11 recommendation, the FHSS, OFDM and DSSS techniques, the taxonomy of the wireless networks, the security and autentification techniques.
The multimedia on CN and the data-security mechanisms on CN.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Cisco Systems:. <I>"Cisco Networking Academy Program" 1-2. a 3-4. díl, Indianapolis, USA 2005</I>. Indianopolis, USA, 2005.
* Dostálek L., Kabelová A. <I>Velký průvodce protokoly TCP/IP a systémem DNS</I>. Praha, 2002. ISBN 80-7226-675-6.
* Janeček J., Bílý M. <I>"Lokální sítě", ČVUT Praha 2004</I>.
* Kállay F., Peniak P. <I>Počítačové sítě</I>. Grada Praha, 2003. ISBN 80-247-0545-1.
* Velte T. <I>"Síťové technologie Cisco, Velký průvodce", Computers Press Brno 2003</I>.

Course title	Programming practise
Course code	KE/IPPRE
Type of course	Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	1
Language	CZ

Name of lecturer

* Rozsíval Pavel, Ing.

Objective

This course serves to improve and better understand the Algorithmization and C Language course. It is designed for students without sufficient practice in programming.
Reasoning, improve practical experience in programming, basic programming tech, orientation in visual studio.

Prerequisities

Course contents

Introduction, examples for algorithms developing - flowcharts.
Algorithm developing and single tasks programming with basic math operators.
Programming exercises with IF, IF-ELSE.
FOR cycle practicing.
WHILE, DO-WHILE practicing.
SWITCH, BREAK and CONTINUE practicing.
Algorithm developing and more complex solution programming. - Combination of more control structures in single solution.
Using methods I.
Using methods II.
Work with single dimensional array.
Work with multi dimensional array.
Practicing of Object Oriented Programming. Exceptions.
Work with strings and files.

Teaching methods

Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Demonstrace, Nácvik dovedností, Pracovní činnosti

Assesment methods

Analýza výkonu studenta, Rozbor produktů pracovní činnosti studenta

Recommended reading

* Gunnerson, E. <I>Začínáme programovat v C#. Computer Press, 2001</I>.
* Liberty, J. <I>Programming C#, O´Reilly, 2001</I>.
* Nagel, Ch., Evjen, B., Glynn, J., Skinner, M.W. <I>C# 2005 - Programujeme profesionálně</I>. Brno: Computer Press, 2007. ISBN 80-251-1181-4.
* Virius, M. <I>C# pro zelenáče. Neocortex</I>. KOPP. ISBN 8072321765.

Course title	Programming of Control Applications
Course code	KE/IPRLE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	4
Language	CZ

Name of lecturer

* Cvejn Jan, doc. Ing. Ph.D.
* Rozsíval Pavel, Ing.

Objective

The main goal of the subject is to familiarize students with object oriented approach to developing software in C#. Course extends skill obtained during IAZPE course. Questions about problems of developing application for MS Windows with graphical user interface (GUI) are also discussed.
Object oriented design of programs, developing event driven applications with WinForms Library in Microsoft Visual Studio.

Prerequisities

KE/IAZPE

Course contents

Introduction to subject, basics terms - class, object, polymorphism, inheritance, encapsulation.
Object creating and deleting - constructors, destructors, memory management (garbage collector in .NET)
Inheritance - Set and Get Methods, Concept of properties in C#. Static members.
Exceptions - exception is object, handling and throwing of exceptions. .NET Exception classes hierarchy.
Relations between classes - simple inheritance, this and base operator. Inheritance vs. combining of classes.
Basics data structures - list, stack, queue.
Polymorphism, virtual methods. Multiple inheritance. Concept of Interfaces in C#.
Implementation of basic interfaces from .NET class library. Structures and their differences from classes.
Event driven programming. Events and delegates in C#. Introduction to operators overloading.
WinForms I - introduction, forms, control elements I
WinForms II - control elements II, dialogs.
WinForms III - GDI+, drawing on forms and control elements.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí

Assesment methods

Ústní zkouška, Posouzení zadané práce, Rozhovor

Recommended reading

* Liberty, J. <I>Programming C#, O´Reilly, 2001</I>.
* Nagel, Ch., Evjen, B., Glynn, J., Skinner, M.W. <I>C# 2005 - Programujeme profesionálně</I>. Brno: Computer Press, 2007. ISBN 80-251-1181-4.
* Petzold, Ch. <I>Programování Microsoft Windows v jazyce C#</I>. SoftPress, 2003. ISBN 8086497542.
* Sells, Ch. <I>C# a Winforms, Zoner Press 2005, ISBN: 80-86815-25-0</I>.
* Virius, M. <I>C# pro zelenáče. Neocortex</I>. KOPP. ISBN 8072321765.

Course title	Computer Networks I
Course code	KE/IPS1
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Dobrovolný Martin, Ing. Ph.D.
* Přívratský Zdeněk, Ing.
* Neradová Soňa, Ing.
* Horálek Josef, Mgr.

Objective

The course provides to students essential knowledge of data transmission theory. The course content is an overview of the basic computer networks knowledges and the main network technologies.
The basic knowledges from computer network area (especially from LAN networks). The student will be able independently and actively solve the dis-functionality of computer networks mainly on 2nd and 3th level.

Prerequisities

Course contents

Introduction:
the computer network (CN) purpose. the CN taxonomy, the general model of CN architecture, the referential model, the CN elements.
Physical layer:
The main properties of the communication path, the modulation techniques, the basic and broad band, the serial and parallel data transmission, the differential and asymmetric signal, the synchronous and asynchronous signal, the practicular realisation on physical layer: RS232, Ethernet, The structured cabling, Blue tooth, Wireless Networks.
The link layer:
The shared medium access, the link-layer addressing. the main link protocols, the Ethernet frame.
Network layer:
IP protocol, IP addresses and masks, ICMP, the packet fragmentation, AGRP, IGMP, The active elements of 3th level
Transport layer:
TCP a UDP protocols, the CN routing techniques and routing protocols.
The routing principles, the routing tables, direct and indirect routing, the routing algorithms, the main routing protocols: RIP, IGRP, E-IGRP, OSPF, EGP, BGP, the access lists.
Application layer:
The function of the application layer, some of the application layer protocols: Telnet, FTP, T-FTP, NFS, SSH and others.
IPv6.
The solutions techniques for decrescent address space problem in IPv4, IPv6 ? new properties, the IPv6 structure, the encryption and authentications methods, the address space and the address representation, the unambiguous addresses, the auto configuration, the modern operation systems IPv6 support.
System DNS
Wireless networks:
The wireless networks made by 802.11 recommendation, the FHSS, OFDM and DSSS techniques, the taxonomy of the wireless networks, the security and autentification techniques.

The multimedia on CN and the data-security mechanisms on CN.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Cisco Systems:. <I>"Cisco Networking Academy Program" 1-2. a 3-4. díl, Indianapolis, USA 2005</I>. Indianopolis, USA, 2005.
* Dostálek L., Kabelová A. <I>Velký průvodce protokoly TCP/IP a systémem DNS</I>. Praha, 2002. ISBN 80-7226-675-6.
* Janeček J., Bílý M. <I>"Lokální sítě", ČVUT Praha 2004</I>.
* Kállay F., Peniak P. <I>"Počítačové sítě", Grada 2003</I>.
* Velte T. <I>"Síťové technologie Cisco, Velký průvodce", Computers Press Brno 2003</I>.

Course title	Computer Simulation of Electronics Circuits
Course code	KE/IPSEE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Pola Marek, Ing.
* Konečný Jiří, Ing. Ph.D.
* Karamazov Simeon, prof. Ing. Dr.

Objective

The aim of this course (Computer Simulation of Electronic Circuits) is the analysis and synthesis (design) of electronic circuits with help of computer, namely with the program SPICE. Though the main stress is on solving of the electronic circuits with help of computer, the solving with help of simplified equivalent circuits without computer is also shown.

After study of this subject student will be able to use computer for analysis and synthesis (design) of relatively complex electronic circuits.

Prerequisities

Course contents

An introduction to the subject, methods of analysis and design of electronic circuits.
Characteristics of basic electronic devices from the point of view of circuit design.
Analysis and design of electrical circuits with help of SPICE - types of analyses.
SPICE models of semiconductor devices - semiconductor diodes, bipolar transistors, JFETs, MOSFETs. SPICE models parameters of these devices.

Transmission lines, subcircuits, operational amplifiers and integrated blocks in SPICE.
Transfer functions for the circuits, input and output impedance, zeroes and poles of a transfer function, time and frequency analyses.
Fourier series and Fourier transform, computation of Fourier series with SPICE. Analysis and design of electrical circuits with help of simplified equivalent circuits of electronic devices.
Analysis and design of amplifiers with bipolar transistors, JFETs, MOSFETs . Their basic characteristics and properties.
Individual works for students. Help with solving of them.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Dobeš J. <I>Návh radielektrických obvodů počítačem, ČVUT Praha, 1997</I>.
* Kejhar M. a kol. <I>Program SPICE v příkladech, ČVUTPraha, 1995</I>.

Course title	Communication Transfer Systems
Course code	KE/IPSYE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Němec Zdeněk, Ing. Ph.D.
* Štěpánek Ladislav, Ing.

Objective

The aim is to introduce the main digital transmission systems, which are used in telecommunication, their fundamental functional principles and basic characteristics.
Here is taught the specific basics of data transport in the PC network, backbone and access network technology, for example PDH (Plesiochronous Digital Hierarchy), SDH (Synchronous digital hierarchy), local data network, Ethernet , ATM (Asynchronous Transfer Mode), optical-electronic networks, mobile networks GSM.

Graduates of the subject get a universal view about the concept of basic cable and wireless communication systems. He/She will be informed about its structure and function and methods of manipulation and transmission signal.

Prerequisities

Course contents

Basic of data communications.
Transmission equipment and network structure.
Reports TCP/IP.
PDH (Plesiochronous Digital Hierarchy).
SDH (Synchronous Digital Hierarchy).
ETHERNET.
ATM (Asynchronous Transfer Mode).
Technology xDSL (Digital Subscriber Line).
Technology ISDN (Integrated Serviced Digital Network).
Technology TMN (Telecommunications Management Network).
Fiber-optic communication , WDM (wavelength-division multiplexing).
GSM (Global System for Mobile communications).

Teaching methods

Monologická (výklad, přednáška, instruktáž), Demonstrace, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Blunár, Diviš. <I>Telekomunikační sítě - 1. díl. VŠB - TU Ostrava, 2003</I>.
* GŘS - Vzdělávací centrum, SPT TELECOM, a. s. <I>Telekomunikační výukové programy. Brno, 1999</I>.
* Svoboda a kolektiv. <I>Telekomunikační technika - 1. - 3. díl. Hutnig & Beneš, Praha, 1999</I>.
* Škorpil, Gregořica. <I>Vysokorychlostní komunikační systémy</I>. VUT, 2004.
* Vodrážka, Pravda. <I>Principy telekomunikačních systémů. ČVUT, 2006</I>.
* Vodrážka. <I>Přenosové systémy v přístupové síti. ČVUT, 2006</I>.

Course title	Sensors and Measurement of Non-Electric Quantities
Course code	KE/ISAME
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	4
Language	CZ

Name of lecturer

* Cvejn Jan, doc. Ing. Ph.D.
* Fribert Miroslav, Ing. Dr.
* Rozsíval Pavel, Ing.

Objective

Course provides the basic knowledge of measurement technological quantity principles within realization of concrete sensors and processing their outputs. Students should acquire practical knowledge of measurement of temperature, pressure, liquid level, flow, analysis of liquid and gases.
Students should acquire knowledge of measurement of basic technological quantity and practical skills.

Prerequisities

Course contents

Measurement network (Static and dynamic characteristic of sensors, error, accuracy and interpretation of measurement)
Passive sensors (resistance, induction, capacity, conductivity, photoelectric)
Active sensors (thermoelectric, piezoelectric, induction, hall sensors)
Signal convertors (operational amplifier, AC and DC bridges, convertors)
Temperature measurement (resistance, semiconductor, thermoelectric, pyrometrical sensors)
Pressure measurement (deformation, induction, capacity, piezoelectric, strain gauge manometers)
Liquid level measurement (mechanical, optical, capacity, conduction and ultrasound level sensors)
Flow measurement (volume, turbine, throttling, electric and special flow measurement)
Density and viscosity measurement (chosen density and viscometer)

Analysis of gases and liquids

Teaching methods

Monologická (výklad, přednáška, instruktáž), Laborování

Assesment methods

Ústní zkouška

Recommended reading

* <I>Automatizační přístroje ZPA Nová Paka. OTS 1982</I>.
* Ďaďo S., Kreidl M. <I>Senzory a měřicí obvody. ČVUT Praha, 1999, ISBN 80-01-02057-6</I>.
* Drábek O., Taufer I. <I>Automatizované systémy řízení technologických procesů</I>. Univerzita Pardubice, 1985.
* Haasz V., Sedláček M. <I>Elektircké měření.</I>. ČVUT Praha, 2000.
* Koropecká H. <I>Měřicí technika</I>. VŠCHT Pardubice, 1989. ISBN 80-85113-05-8.
* Váňa, J. <I>Analyzátory plynů a kapalin. SNTL Praha 1984</I>.

Course title	Communication technology
Course code	KE/ISTEE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	6
Language	CZ

Name of lecturer

* Bezoušek Pavel, prof. Ing. CSc.
* Němec Zdeněk, Ing. Ph.D.
* Pidanič Jan, Ing.

Objective

The subject aim is to make students aquainted with the basic principles of signal and information transfer and processing and with the signal processing technology in communication. In the course the determined signals characteristics, signal spectra, telecommunication network and channels structures, radio path, optical path, analogue and discrete modulation, realization of modulators and demodulators.
After passing the course, the student will understand basic characteristics of signals in communication and will be able to calculate signals characteristics, and their spectra. He will be acquainted with structure of a communication channel, its characteristics and parameters, of structure of the radiopath and of optical path, of their parameters and characteristics. He also understand analogue and discrete modulation of the harmonic carrier, their characteristics and applications.

Prerequisities

Course contents

Introduction: Communication technology taxonomy, communication channel and its structure, signal classification, time domain signal characteristics, selected signals: Rectangular pulse, Diraqe pulse, unity step pulse.
Periodical signals: Definition and characteristics, Fourier series and spectra. Selected periodic signals and their characteristics, relation between the time and frequency domains.
Non-periodical signals: power and energetic signals, Fourier transform, spectrum of non-periodical signals, selected non-periodical signals , their characteristics and spectra. Relation between the Fourier series and the Fourier transform.
Radio path: Characteristics, structure of the radiopath, spherical and plane wave propagation, propagation loss, refraction, multipath phenomena.
Antennas: their characteristics, radiocommunication (beacon) equation, power budget of the radiopath, transmitter and receiver.
Optical path: Basic characteristics of the optical path, optical spectra, optical path structure. Propagation of the optical energy through the optical fiber, types and characteristics of the optical fibers, power budget of the optical path.
Channel capacity, transport and modulation velocity. Modulation - definition and reasons of application. Multiplexing, definition and type of multiplex.
Amplitude modulation of the harmonic carrier (AM): AM signal description, spectra, types of AM. Modulators and demodulators, coherent demodulation, carrier regeneration.
Angle modulation: relation between phase (PM) and frequency (FM) modulations, spectra, modulators and demodulators, phase lock loop, application of PM, FM.
Discrete modulations of the harmonic carrier: ASK, FSK (CPM, MSK, GMSK), PSK (BPSK, QPSK, OK PSK), QAM.
Multicarrier modulation DMT, OFDM, principles and characteristics.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Demonstrace, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Pearson J. <I>Basic Communication Technology, Prentice Hall, 1992 ISBN 0-13-061078-X</I>.
* Svoboda J. a kol. <I>Telekomunikační technika, Díl 1, Hüthig a Beneš, Praha 1999, ISBN 80-901936-3-3</I>.
* Svoboda J. a kol. <I>Telekomunikační technika, Díl 2, Hüthig a Beneš, Praha 1999, ISBN 80-901936-4-1</I>.

Course title	Technical Drawing and CAD in Electrical Engineering
Course code	KE/ITCAD
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	5
Language	CZ

Name of lecturer

* Doleček Radovan, doc. Ing. Ph.D.
* Hanus Milan, Ing.
* Pešek Jiří, Ing.

Objective

The purpose of this subjekt is inform students about the fundamental rules of creation technical dokumentation, especially in mechanical and electrical engineering, using modern CAD systems for the designing and for generation technical drawings. The inseparable part of the lectures is acquaintance with safety instructions in electrical engineering.

On completion of the subject student is competent read and create the technical documentation, independently use CAD systems and well versed in safety instructions in electrical engineering.

Prerequisities

Course contents

Technical documentation.
Technical standardization.
General methods and rules of representation.
Dimensioning and tolerancing of dimensions.
Representation and dimensioning of machine elements and features.
Geometrical tolerances.
Indications of surface texture.
Technical documentation in electrical engineering and other fields of engineering.

Graphical symbols for wiring diagrams.
Professional qualifications in electrical engineering.
Kinds of touching, endangering by current.
Electrical accidents and first aid at the workplace.
Protective measures, classes of protection.
Types of protection of electrical equipments.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody samostatných akcí, Nácvik dovedností

Assesment methods

Posouzení zadané práce, Rozbor produktů pracovní činnosti studenta, Didaktický test, Rozhovor

Recommended reading

* Ellen Finkelstein. <I>Mistrovství v AutoCADu pro verze 2004 až 2006</I>. CP Books, 2005.
* KLETEČKA, J.; FOŘT, P. <I>Učebnice AutoCADu 2006</I>. Praha: ComputerPress, 2007. ISBN 80-251-0567-9.
* Šťastný J., Třeštík B., Klepš Z. <I>Manuál technické dokumentace (5. přepracované vydání)</I>. České Budějovice: KOPP, 2004.

Course title	Theoretical Electrical Engineering
Course code	KE/ITELE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	7
Language	CZ

Name of lecturer

* Schejbal Vladimír, prof. Ing. CSc.
* Jaroš Otakar, Ing.
* Kupka Libor, Ing. Ph.D.

Objective

The course provides to students with Maxwell's equations. Transmission lines, impedance, matching, reflections, standing waves.
Students are able to orientate in electrostatics, steady currents, static magnetic field, electromagnetic fields, Maxwell equations and wave propagation problems. They can analyze DC and AC circuits (transients and steady states).

Prerequisities

Course contents

Students are able to orientate in electrostatics, steady currents, static magnetic field, electromagnetic fields, Maxwell equations and wave propagation problems. They can analyze DC and AC circuits (transients and steady states).

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Ústní zkouška

Recommended reading

* <I>http://ieeexplore.ieee.org/Xplore/dynhome.jsp</I>.
* <I>http://www.radioeng.cz/search.htm</I>.
* BEZOUŠEK, P., SCHEJBAL, V., ŠEDIVÝ, P. <I>Elektrotechnika</I>. Univerzita Pardubice, 2008. ISBN 978-80-7395-101-6.
* PAUL, C. R. <I>Electromagnetics for engineers : with applications to digital systems and electromagnetic interference.</I>. John Wiley & Sons, 2004.
* SCHEJBAL, V. et al. <I>Elektrotechnika. Příklady</I>. Univerzita Pardubice, 2004. ISBN 80-7194-560-9.

Course title	High frequency technology for telecommunications
Course code	KE/IVFTE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS
Number of credits	4
Language	CZ

Name of lecturer

* Fišer Ondřej, doc. Ing. CSc.

Objective

The goal of this subject is to make students acquainted with basic high frequency technology (high frequency circuits, lines, waveguides, spatial electromagnetic wave propagation, antennas and electromagnetic compatibility aiming at utilisation in telecommunications.)
The student is able to tackle signal transmission from the source to the load (line, waveguide) and also from the transmitter to the receiver at the defined volume considering antenna properties including the transmission of interference signals. The student can work with the Smith (impedance) chart, can perform impedance matching, and take basic electromagnetic compatibility bearings.

Prerequisities

Course contents

Utilisation of the high frequency technology in telecommunications, basic definitions.
High frequency circuits of widespread parameters, basic types of high frequency lines & properties, line discontinuities, impedance matching, resonators.
Basic properties of electromagnetic waves.
Propagation of space and ground (surface) waves, propagation of radio waves in satellite communications, ionosphere propagation
Theory of antennas, basic types of antennas (dipole, wide band antennas, surface (areal) antennas, antenna arrays.
Scattering parameters and its measurement
Electromagnetic compatibility

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* BEZOUŠEK, P., SCHEJBAL, V., ŠEDIVÝ, P. <I>Elektrotechnika</I>. Univerzita Pardubice, 2008.
* Černohorský, D. a kol. <I>Elektromagnetické vlny a vedení. Brno: VUTIUM. 1999.</I>. VUTIUM, 1999.
* GREGORA, S., FIŠER, O. <I>Elektrotechnika (elektronická forma učebnice), Univerzita Pardubice, 2005.</I>.
* Mazánek, M., Pechač, P., Vokurka, J. <I>Antény a šíření vln. Vydavatelství ČVUT, 1999.</I>.
* Prokop, Vokurka. <I>Šíření elektromagnetických vln a antény. SNTL Praha, 1980.</I>. Praha, SNTL, 1980.
* SCHEJBAL, V. et al. <I>Elektrotechnika. Příklady</I>. Univerzita Pardubice, 2004. ISBN 80-7194-560-9.
* Svačina, J. <I>Základy elektromagnetické kompatibility,VUT Brno, 2001.</I>. Brno: Vysoké učení technické, 2001.
* Tysl, V., Růžička, V. <I>Teoretické základy mikrovlnné techniky. SNTL, Praha, 1989.</I>.

* Vrba, J. <I>Technika velmi vysokých frekvencí. Praha: ČVUT. 1998.</I>. ČVUT, 1998.

Course title	Selected Radiocommunication Systems
Course code	KE/IVRSE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	4
Language	CZ

Name of lecturer

* Filip Aleš, doc. Ing. CSc.
* Němec Zdeněk, Ing. Ph.D.

Objective

The course provides to students essential knowledge of wireless systems - television broadcasting, mobile communication systems, modulation and multiplexing in mobile communication systems, WiFi and satellite positioning system.
The students acquire theoretical and practise knowledge and skills of wireless communication technology.

Prerequisities

Course contents

Radio-communication systems overview.
Signal propagation. Propagation loss model within various environments.
Broadcasting.
Television broadcasting, chrominance signals.
Digital television (DTV). Terrestrial DTV broadcasting, OFDM.
Mobile communication systems.
Modulation and multiplexing in mobile communication systems.
Orthogonal Frequency-Division Multiple Access.
Wireless communication technology - WiFi.
Wireless personal area networks.
Positioning systems.
Satellite positioning system - technical description, navigation signals, calculating positions.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Demonstrace, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Dobeš J., Žalud V. <I>Moderní raditechnika</I>. BEN Praha, 2006.
* Žalud V. <I>Multimediální přenos signálů, skripta ČVUT, Praha 1995</I>.
* Žalud V. <I>Základy radioelektroniky, skripta ČVUT, Praha 1992</I>.

Course title	Digital Engineering - Basic Course
Course code	KE/IZCTE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	5
Language	CZ

Name of lecturer

* Marek Josef, Ing. CSc.

Objective

To acquaint students with basic terms and methods from the field of digital technic.

Elementary knowledge from the field of digital technic necessary for next studies.

Prerequisities

Course contents

The history of semiconductors and integrated circuits, digital integrated circuits.
Numeral systems and codes.
Boolean algebra.
Logic functions minimization.
Logic functions realization.
Multiplexers, code converters, adders, multipliers.
Hazards in logic circuits.
Sequential logic, description, synthesis.
Shift registers, counters.
Memories and their usage.
Interfacing digital circuits.
Microprocessors: history and terminology.
Intro to PC hardware.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Laborování

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* Bayer J., Hanzálek Z., Šusta R. <I>Logické systémy pro řízení</I>. Praha, ČVUT, 1999.
* Friedman A.D., Menon P.R.:. <I>Teorie a návrh logických obvodů, SNTL, Praha 1983</I>.
* Kubátová H., Blažek Z.:. <I>Logické systémy (cvičení), skripta ČVUT, 1996</I>.
* Pluháček Alois:. <I>Projektování logiky počítačů, ČVUT Praha, 1995</I>.
* Strnad L.:. <I>Základy číslicové techniky (cvičení), skripta ČVUT, 1996</I>.

Course title	Principles of Electronic Engineering
Course code	KE/IZSE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	LS
Number of credits	4
Language	CZ

Name of lecturer

* Fišer Ondřej, doc. Ing. CSc.
* Kupka Libor, Ing. Ph.D.
* Pešek Jiří, Ing.

Objective

Electrostatic field in vacuum, in general media, capacitance, energy and forces, fields solutions.
Stationary current field, current conduction mechanism in material.
Ohms law, Kirchhoffs laws, DC circuits solution.
Variable voltages and currents, variables characterizing variable voltages and currents, AC circuits.
Magnetic field, Biot-Savart law, Amperes law, magnetic field in material.
Magnetic field forces effects on a moving charge and current lead, Hall effect, skin effect.
Electromagnetic induction, Faraday´s law, Lenzes law, self-inductance and mutual inductance .
Transient effects, condenser charging and discharge, current rise and cut-off in inductor.
Homogeneous line signal transmission.
Semiconductor technology, PN junction, diode, bipolar transistor, diodes and transistors applications.
Boolean algebra, digital technique.
EMC, disturbance and its sources, coupled mechanisms of disturbance transmission.
Electromagnetic shielding, EMI, EMS and testing.
After completing the course the student is familiar with the basics of low-voltage electrical engineering.

Prerequisities

Course contents

Introduction, electrostatic field in vacuum, in general media, capacitance, energy and forces, fields solutions.
Stationary current field, current conduction mechanism in material.
Ohms law, Kirchhoffs laws, DC circuits solution.
Variable voltages and currents, variables characterizing variable voltages and currents, AC circuits.
Magnetic field, Biot-Savart law, Amperes law, magnetic field in material.
Magnetic field forces effects on a moving charge and current lead, Hall effect, skin effect.
Electromagnetic induction, Faraday´s law, Lenzes law, self-inductance and mutual inductance .
Transient effects, condenser charging and discharge, current rise and cut-off in inductor.
Homogeneous line signal transmission.
Semiconductor technology, PN junction, diode, bipolar transistor, diodes and transistors applications.
Boolean algebra, digital technique.
EMC, disturbance and its sources, coupled mechanisms of disturbance transmission.
Electromagnetic shielding, EMI, EMS and testing.

Teaching methods

Monologická (výklad, přednáška, instruktáž)

Assesment methods

Ústní zkouška, Písemná zkouška

Recommended reading

* BEZOUŠEK, P., SCHEJBAL, V., ŠEDIVÝ, P. <I>Elektrotechnika</I>. Univerzita Pardubice, 2008. ISBN 978-80-7395-101-6.
* PAUL, C. R. <I>Electromagnetics for engineers : with applications to digital systems and electromagnetic interference.</I>. John Wiley & Sons, 2004.
* SCHEJBAL, V. et al. <I>Elektrotechnika. Příklady</I>. Univerzita Pardubice, 2004. ISBN 80-7194-560-9.

Course title	Digital Signal Processing
Course code	KE/VCZS2
Type of course	Lecture
Level of course	Ph.D.
Year of study	0
Semester	LS
Number of credits	0
Language	CZ

Name of lecturer

* Konečný Jiří, Ing. Ph.D.
* Bezoušek Pavel, prof. Ing. CSc.

Objective

The aim of the subject is to gain a deeper knowledge about a signal processing in discrete systems and a knowledge about basic methods of the signal processing with help of computers. The content of the subject is the theory of discrete-time systems, discretization and quantization of signals, design of digital filters in time and frequency domain, realization and using of discrete Fourier transformation, processing of random signals, estimation of the spectrum of noised signals and processing of signals with more dimensions.

Digital Signal Processing

Prerequisities

Course contents

Theory of discrete signal processing systems and mastering the basic techniques of signal processing on the computer. Theory of linear discrete systems, discretization and quantization, design of digital filters in time and frequency domain, implementation and use of DFT algorithms, processing of random signals, linear prediction and estimation of the spectrum vícedimenzionálního processing.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Jan J. <I>Číslicová filtrace, analýza a restaurace signálů</I>. VUT, Brno, 1997.
* Uhlíř, J., Sovka, P. <I>Číslicové zpracování signálu</I>. ČVUT.

Course title	Signals and Systems
Course code	KE/VSAS1
Type of course	Lecture
Level of course	Ph.D.
Year of study	0
Semester	ZS
Number of credits	0
Language	CZ

Name of lecturer

* Bezoušek Pavel, prof. Ing. CSc.

Objective

Basic characteristics of deterministic and random signals, signal representation in time and frequency domains, linear time invariant systems, narrow-band HF signals, the complex envelope, signal sampling, DFT, FFT, signal modulation/demodulation, random signals estimation, signal detection in noise.
Signals and Systems

Prerequisities

Course contents

Signal classification and its chatracteristics.
Selected signals.
Generalized Fourier Series.
Continuous -Time Linear Systems, causality and stability, output signals characteristics.
Discrete - Time Linear Systems, causality and stability, output signals characteristics.
Spectral Representation of a periodic signal.
Spectral Representation of a non-periodic signal.
Discrete Fourier Transform, Fast Fourier Transform, algorithms, application on various types of signals.
Spectral Representation of LTI Systems, Continuous and Discrete Systems.
Output Signal Characteristics, Continuous - Time System Substitution by a Discrete-Time System.
Bandpass Signals and their Representation: Analythic Signal, Complex Envelope.
Signal Sampling and Recovery.
Random Signals and their Characteristics.
Random Signals in LTI Systems.
Random Signals in Non-linear Systems.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* HRDINA, Z., VEJRAŽKA, F. <I>Signály a soustavy, ČVUT Praha, 1998</I>. ČVUT Praha, 1998.
* TAYLOR, J.F. <I>Principles of Signals and Systems</I>. McGraw-Hill, Inc., 1994. ISBN 0-07-911171-8.

Course title	Electronic Devices and Circuites
Course code	KE/ZESOE
Type of course	Lecture + Lesson
Level of course	null
Year of study	0
Semester	ZS+LS
Number of credits	5
Language	AN

Name of lecturer

* Konečný Jiří, Ing. Ph.D.

Objective

Introduction to the theory of semiconductors, carriers of the current, P-N junction. Semiconductor diodes, their types, features and using. Bipolar transistors, types, characteristics and usage. Other bipolar devices (controlled rectifiers, LED,?). Unipolar transistors, types, characteristics, usage. Analog and digital integrated circuits. Equivalent circuits for diodes and transistors, their usage for amplifier design. Main characteristics of the amplifiers with transistors connected with common emitter, base, collector. Operational amplifiers, their characteristics and usage.
After the study of this subject student will have attainments from the area of electronic devices, especially semiconductor devices - diodes, transistors , thyristors (controlled diodes), .. These attainments are pre-requisite for study of another subjects.

Prerequisities

Course contents

- An introduction. Types of matter from the point of electrical current conduction. Conductors, semiconductors, insulators. Basic theory of semiconductors, semiconductor junction.
- Semiconductor diodes. V-A characteristic of a diode, types of diodes, their equivalent circuits, usage.
- Examples of using of the semiconductor diodes in power supplies, detectors. - Bipolar transistors, PNP, NPN. Their characteristics and equivalent circuits. Types of bipolar transistors and their usage.
- Using of bipolar transistors in amplifiers. Main characteristics of a transistor connected with common emitter, characteristics of an amplifier with transistor connected with common emitter.
- Main characteristics of a transistor connected with common base and common collector, characteristics of amplifiers with transistor connected with common base and common collector.
- Devices with more layers of semiconductor - thyristor, triac. Their function, characteristics, usage. Examples of circuits using thyristors and triacs.
- Unipolar transistors. Basic types of unipolar transistors. Function, characteristics, usage. Equivalent circuits.
- Examples of using of unipolar transistors in amplifiers and integrated circuits. Characteristics of circuits with unipolar transistors.
- Optoelectronic devices - photodiodes, LED, display devices.
- Integrated circuits. Types of integrated circuits - analog, digital, bipolar, unipolar, size of integration
- Operational amplifiers. Main characteristics, equivalent circuits, usage.
- Examples of using of operational amplifiers in such circuits as amplifiers, integrators, precision rectifiers, generators. Function, properties of these circuits.
- Digital (logical) integrated circuits.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Antognetti, P., Massobrio, G. <I>Semiconductor Device Modelling with SPICE, McGraw-Hill</I>.
* Clifton, Fonstad. <I>Microelectronic Devices and Circuits</I>.

Course title	Introduction to Microprocessors
Course code	KE/ZMTEE
Type of course	Lecture + Lesson
Level of course	null
Year of study	0
Semester	ZS+LS
Number of credits	5
Language	AN

Name of lecturer

* Hájek Martin, Ing.

Objective

This course provides students with the basic concepts of microcomputers, microprocessor architectures, low and high-level oriented programming of microprocessors and their applications, especially in embedded designs. Practical aspects are demonstrated on 8-bit architecture Atmel AVR.
Be able to apply any microprocessor, self-study of literature provided by manufacturers of microprocessors, assembler oriented programming of RISC microprocessors.

Prerequisities

Course contents

Numbers in digital logic: Integer and real numbers, fixed and floating point representation, signed integer numbers - two's complement, Sign-and-magnitude, biased representation.
Basic terms: computer, microcomputer, CPU, bus. Introduction to semiconductor memories. Instructions. Computer architectures.
History of Microprocessors. RISC and CISC philosophy of design of microprocessor. Basic schema of Central Processor Unit (CPU). Instruction.
Instruction Set Architecture (ISA) - types of, addressing modes. Instruction cycle. Reset of CPU.
Introduction to CPU construction - design of ALU and Control Unit of simple CPU.
ISA Atmel AVR - core, instruction set, Introduction to programming in assembly language.
Floating point representation of real numbers - principles, IEEE754 standard. Integer and floating point arithmetic.
Stack and subroutines.
Computer buses - three-state logic, chip select logic, address decoders, basic bus cycles - read and write, multiplexed buses.
Peripheral devices. Memory mapped devices. AVR - input/output, timer/counter
Interrupt system - basic principles, interrupt handlers (subroutines), latency, priority, nested interrupts
memory subsystem of computers - memory hierarchy, cache memories, virtual memory

Key to power of modern CPU - pipelining, SIMD, VLIW and superscalar CPU.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí

Assesment methods

Ústní zkouška, Posouzení zadané práce, Rozhovor

Recommended reading

* <I>Novice's Guide to AVR Development, www.atmel.com/dyn/resources/prod_documents/novice.pdf</I>.
* Arnold K. <I>Embedded Controller Hardware Design, LLH Technology Publishing, 2001</I>. 2001.
* Murdocca M., Heuring V. <I>Principles of computer architecture, Prentice Hall, 1999, ISBN-10: 0201436647</I>. Prentice Hall, 1999. ISBN 10: 0201436647.

Course title	Analog and Digital Signal Processing
Course code	KE/ZNZSE
Type of course	Lecture + Lesson
Level of course	null
Year of study	0
Semester	ZS+LS
Number of credits	5
Language	AN

Name of lecturer

* Konečný Jiří, Ing. Ph.D.

Objective

Introduction to signal processing , Fourier series, Fourier transform, Z transform, sampling process, discrete Fourier transform, FFT, linear time-invariant systems, digital filters with FIR and IIR, effects of finite word lengths, random signals and their spectral analysis, examples of digital signal processing systems (audio, image, radar).
Student will be able to work with Fourier transform, Z-transform, discrete Fourier transform, digital filters and other digital signal processing circuits. He (she) will be able to use this knowledge for realisation of concrete digital signal processing equipment.

Prerequisities

Course contents

An Introduction to digital signal processing (DSP). Content of the course. Signals and their types.
Analog to Digital Converter (ADC) and Digital to Analog Converter (DAC) as a part of digital signal processing. Main characteristics of the converters. Number systems for DSP, principal operations in binary number systems.
Fourier series. Decomposition of a signal to Fourier series. Spectrum of a signal. Time sampling and amplitude quantization of a signal.
Sampling period and number of bits requirements needed for undistorted information transmission.
Amplitude quantization errors for rounding and truncation, statistical parameters of the quantization errors.

Direct and back Fourier transform, Z-transform.
Principal characteristics of a signal, mean values, power, energy, autocorrelation, crosscorrelation,..
Linear time invariant systems (LTIS) as a principal DSP systems.
Output signal from LTI system as a convolution of an input signal and an impulse response of the system. Impulse response, step response, convolution and their transform.
DFT and FFT.
Digital filters, digital filters with finite impulse response (FIR).
Digital filters with infinite impulse response (IIR).
Digital processing of random signals, spectral analysis of random signals.
Examples of DSP (audio, image, radar).

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí, Laborování

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Antoniou A. <I>Digital signal processing</I>. McGraw-Hill, 2005.
* Hayes M.H. <I>Digital signal processing</I>. McGraw-Hill, 1999.
* Smith S.W. <I>Digital signal processing</I>. California Technical Publishing, 1999.
* Zelniker, G., Taylor, F.J. <I>Advanced digital signal processing</I>. Marcel Dekker, New York, 1994.

Course title	Computer Simulation of Electronics Circuits
Course code	KE/ZPSEE
Type of course	Lecture + Lesson
Level of course	Bc.
Year of study	0
Semester	ZS+LS
Number of credits	5
Language	AN

Name of lecturer

* Konečný Jiří, Ing. Ph.D.

Objective

The aim of this course is the analysis and synthesis (design) of electronic circuits with help of computer, namely with the program SPICE.
Though the main stress is on solving of the electronic circuits with help of computer, the solving with help of simplified equivalent circuits without computer is also shown.

After study of this subject student will be able to use computer for analysis and synthesis (design) of electronic circuits

Prerequisities

Course contents

- An introduction to the subject, methods of analysis and design of electronic circuits.
- Analysis and design of electrical circuits with help of SPICE, types of analyses.
- SPICE models of semiconductor devices - semiconductor diodes, bipolar transistors, JFETs, MOSFETs.
- Subcircuits, operational amplifiers and integrated blocks in SPICE.
- Transfer functions for the circuits, input and output impedance, zeroes and poles of a transfer function, time and frequency behaviours .
- Fourier series and Fourier transform, computation of Fourier series with SPICE.
- Analysis and design of electrical circuits with help of simplified equivalent circuits of electronic devices.
- Analysis and design of amplifiers with bipolar transistors, JFETs, MOSFETs .
- Analysis and design of DC power supplies with help of rectifiers, regulators. Switching power supplies.
- Linear integrated circuits, operational amplifiers, active filters.
- Multivibrators, oscillators, and other electronic circuits.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Antognetti, P., Massobrio, G. <I>Semiconductor Device Modelling with SPICE, McGraw-Hill</I>.
* Vladimirescu, A. <I>The SPICE Book, John Willey & Sons, Inc.</I>. 1994.
* www. microsim.com. <I>www. microsim.com</I>.

Course title	Electronic Communication
Course code	KE/ZSTEE
Type of course	Lecture
Level of course	null
Year of study	0
Semester	ZS+LS
Number of credits	6
Language	AN

Name of lecturer

* Bezoušek Pavel, prof. Ing. CSc.

Objective

Summary of fundamentals of information and signals classification and characteristics. Spectral representation of periodic, nonperiodic and random signals. Communication channel diagram. Analogue and discrete modulation of a harmonic carrier, impulse modulation. Modulators and demodulators. Multiplexing.
Students will receive fundamentals of information transfer, signals classification and characteristic, including spectral representation. They will get a deep insight in analogue and discrete modulation of a harmonic carrier and impulse modulations as well as in modulators and demodulators in use.

Prerequisities

Course contents

Introduction: Basic taxonomy - Information, message, data, signal, (tele)communication, transmission channel, transmission medium.
Summary of information theory in communication: Information, logarithmic measure of information, entropy, redundancy
Signal classification and characterization. Deterministic and random signals and their characterization. Signal spectra, transfer functions, time and frequency domains.
Transport media - metal cables, optical cables, radio channel, their characteristics and parameters. Linear distortion, ISI.
Base-band signals and motivation for signal modulation. Classification of modulation methods and carriers.
Pulse analogue modulations: PAM, PWM, PPM, PFM. Signal generation and recovery. Discrete pulse modulations, quantization: QPAM, DM, PCM. Noise, quantization noise, BER.
Analog amplitude modulation of a harmonic carrier: full AM, DSB, SSB, SC. Characteristics, parameters, modulators, demodulators.
Analog frequency (FM) and phase (PM) modulation of a harmonic carrier: relation between FM and PM, single sinusoid modulation, band-pass modulation, parameters, comparison of analog modulation methods.
Phase and frequency modulators and demodulators. Carrier recovery. Receiver synchronization.
Discrete modulations of a harmonic carrier: amplitude mod. - ASK, frequency mod. - FSK, CPFSK, MSK, phase mod. - PSK, BPSK, QPSK, hybrid modulation - QAM.
Discrete modulators and demodulators. Parameters.
Multiplexing: FDM, TDM, WDM, CDM. TDM hierarchy, SDH, PDH.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Dialogická (diskuze, rozhovor, brainstorming), Metody samostatných akcí, Demonstrace

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* J. Pearson. <I>Basic Communication Theory</I>. Prentice Hall, 1991.
* J. Proakis. <I>Digital Communication, 1996</I>. Mc Graw Hill Inc, 2002.
* TAYLOR, J.F. <I>Principles of Signals and Systems</I>. McGraw-Hill, Inc., 1994. ISBN 0-07-911171-8.

Course title	Digital Circuits
Course code	KE/ZZCT
Type of course	Lecture + Lesson
Level of course	null
Year of study	0
Semester	ZS+LS
Number of credits	4
Language	AN

Name of lecturer

* Marek Josef, Ing. CSc.

Objective

Introduction to logic systems, truth tables, Boolean algebra, logic functions, standard forms of logic expressions, minterms, maxterms, Karnaugh maps, simplification of logical functions, logic gates and their parameters, types of flip-flops, finite state machines, binary adders, subtracters, multipliers, comparators, decoders, encoders, registers, counters, synchronous logical circuits.
Student will be able to understand the functioning of basic digital circuits and will be able to use the knowledge for design of concrete digital circuits.

Prerequisities

Course contents

Integrated logic circuits, types of integrated logic circuits (ILC) (hybrid, monolithic), scale of integration of ILC, technologies of ILC. Electronic circuits of typical basic digital circuits. Values of logic levels for low and high state.
Number systems, conversion from one number system to other. Fixed radix systems. Binary number system. Coding of numbers expressed in system with some radix in binary number system.
Basic Boolean rules, Boolean functions expressed with truth table, using of Boolean rules for simplification of Boolean functions.
Basic Boolean logic functions (AND, OR, INVERT) used for writing of general Boolean functions. Minimization made with help of Boolean rules, Karnaugh maps, Quine-McCluskey method.
Terms, minterms, maxterms, fundamental sum of products and fundamental product of sums. Combinational logic circuits.
Decomposition of logic functions and its using for logic circuits design.
Basic mathematical operations in binary number system. Their realization with help of logic circuits. Binary adder, binary subtracter. Realization of more complicated functions (operations).

Realization of logical functions with help of multiplexers, decoders, read only memories.
Flip-flops as a special case of sequential logic circuits. R-S, J-K, D, T -flip-flops.
Design of combination sequences (special sequential circuits) with J-K, D, T flip flops.
Register, shift register, their realization and using.
Two's complement, mathematical operations in two's complement.
Sequential circuits, design of synchronous sequential circuits, sequential machine.
Main parts of microprocessors, microcomputers, personal computers.

Teaching methods

Monologická (výklad, přednáška, instruktáž), Metody práce s textem (učebnicí, knihou), Metody samostatných akcí

Assesment methods

Ústní zkouška, Písemná zkouška, Posouzení zadané práce

Recommended reading

* Brown, S., Vranesic, Z. <I>Fundamentals of Digital Logic with VHDL Design with CD-ROM,</I>.
* Mano, M.M. <I>Computer Systems Architecture, Prentice-Hall, 1993,</I>.
* Mi Lu. <I>Arithmetic and Logic in Computer Systems, Wiley, 2004, ISBN 0-47146945-9, Eu 53</I>.
* Tokheim, R.L. <I>Schaum's Outline of Digital Principles, 1994, McGraw-Hill, ISBN 0070650500, asi $20</I>.