EQUIVALENCIA DE MATERIAS

Materia a cursar en la universidad destino; Materia equivalente en la Universidad del Magdalena; *Facultad en donde se cursarán las materias en la universidad destino.*

Physics 2 (7) = Física Fluidos Calor y Ondas (4), Física Moderna (3). *(Faculty of Electrical Engineering)*

Code: **BE5B02PH2**	**Physics 2**	
Lecturer: prof. Ing. Stanislav Pekárek CSc.	Weekly load: 3P+1L+2C	Completion: A, EX
Department: 13102	Credits: 7	Semester: W

Description:

Within the framework of this course the students will first of all learn foundations of thermodynamics. Following topic - the theory of waves - will give to the students basic insight into the properties of waves and will help to the students to understand that the presented description of the waves has a universal character in spite of the waves character. Particular types of waves, such as acoustic or optical waves are the subjects of the following section. Quantum mechanics and nuclear physics will complete the student?s general education in physics. The knowledge gained in this course will help to the students in study of such modern areas as
robotics, computer vision, measuring technique and will allow them to understand the principles of novel technologies and functioning of new electronic devices.

Contents:

Lectures
1. Thermodynamic systems, state variables, temperature, heat, work, internal energy, ideal gas law, heat capacities, 1st and 2nd law of thermodynamics, thermodynamic processes, heat engines, entropy, heat transfer (conduction, convection and radiation), 3nd law of thermodynamics, thermal expansion, kinetic theory of gases.
2. Fundamentals of waves (phase velocity, group velocity, dissipation and dispersion of waves, dispersion relationship) general wave equation. Doppler effect. Wave equation for electromagnetic and acoustic waves, propagation of electromagnetic and acoustic waves.
3. Constructive and destructive interference, coherent waves, diffraction, Huygens´ principle.
4. Geometrical optics, light ray, paraxial approximation, Fermat´s principle, reflection and refraction, critical refraction.
5. Wave optics - Fresnel´s and Fraunhofer´s diffraction, interference of light.
6. Polarization and dispersion of light. Anisotropic media, Brewster law, application of polarization, liquid crystals.
7. Introduction to quantum mechanics - black-body radiation, photoelectric and Compton´s effect, Bohr´s model of atom.
8. Wave particle duality, wave function, de Broglie hypothesis, Born probability.
9. Schrodinger´s equation, (free particle, particle in a potential wall, tunnel effect, harmonic oscillator), uncertainty principle.
10. Motion in the central field, quantization of angular momentum, quantum numbers, spin, Fermions and bosons, Pauli exclusion principle.
11. Band theory of solids (conductors, semiconductors and dielectrics).
12. Lasers, spontaneous and stimulated emission, inverse population.
13. Fundamentals of nuclear physics, (nuclear properties, radioactivity, fission and fusion).

Seminar contents:

Temperature and heat
Thermodynamics
Waves, acoustic waves
Electromagnetic waves
Geometrical optics
Quantum physics
Nuclear physics

Electromagnetic fields (6) = Campos Electromagnéticos (3). *(Faculty of Electrical Engineering)*

Code: **BE5B17EMT**	**Electromagnetic Field Theory**	
Lecturer: prof. Ing. Zbyněk Škvor CSc.	Weekly load: 3P+2C	Completion: A, EX
Department: 13117	Credits: 6	Semester: W

Description:

This course presents fundamentals of electromagnetic field theory and its applications. Analysis methods proper for static, stationary as well as dynamic fields and waves in free space and on basic transmission lines are presented as well. This course provides students with physics - based view on studied effects, which is applied then on engineering problems. At the end of the course, all effects should not only be described, but quantified as well. Basic knowledge and insight into communication devices, systems and techniques is provided, applicable not only to systems currently taught in other courses, but to future systems as well.

Contents:

1. Basic principles, field sources, charge(s) and current(s).
2. Field caused by charges, Laplace and Poisson equation, polarisation, capacity.
3. Magnetic field caused by steady current. Self and mutual inductance.
4. Magnetic circuit analysis, ferromagnetics.
5. Induction law. Nonstationary fields. Maxwell equations, practical explanation.
6. Energy and force contained in/caused by electromagnetic field
7. Electromagnetic wave, wave equation and its solution in the case of planar harmonic wave
8. Planar waves in lossy media, waves at planar interfaces, Snell's law
9. Poynting theorem. Fields and waves in conductive media.
10. Analytic and numeric analysis and its applications
11. Guided waves, transmission lines and its parameters, transmission, reflection, impedance
12. Smith chart, parameters on display and its application in impedance matching
13. TEM transmission lines, coaxial, Lecher ad other line types
14. Waveguide with rectangular crossection, parameters, modes, resonators.

Seminar contents:

1. Basic principles, field sources, charge(s) and current(s).
2. Field caused by charges, Laplace and Poisson equation, polarisation, capacity.
3. Magnetic field caused by steady current. Self and mutual inductance.
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5. Induction law. Nonstationary fields. Maxwell equations, practical explanation.
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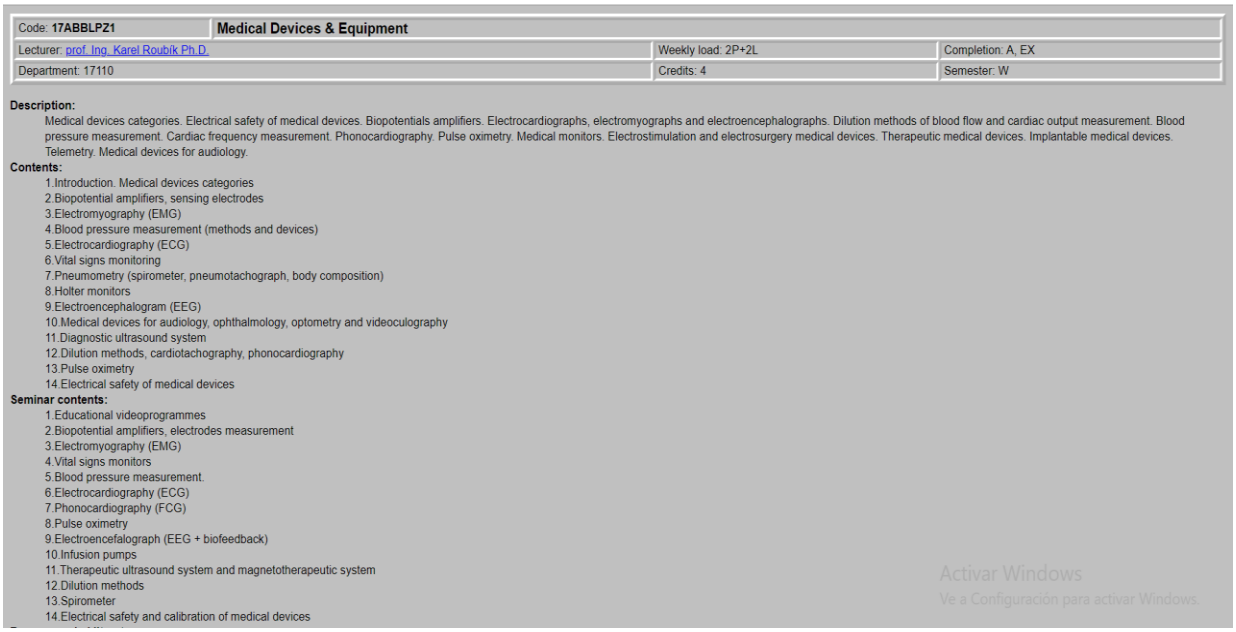
Medical Devices and Equipment (4) = Instrumentación hospitalaria (4). *(Faculty of Biomedical Engineering)*



Code: 17ABBLPZ1	Medical Devices & Equipment	
Lecturer: prof. Ing. Karel Roubík Ph.D.	Weekly load: 2P+2L	Completion: A, EX
Department: 17110	Credits: 4	Semester: W

Description:

Medical devices categories. Electrical safety of medical devices. Biopotentials amplifiers. Electrocardiographs, electromyographs and electroencephalographs. Dilution methods of blood flow and cardiac output measurement. Blood pressure measurement. Cardiac frequency measurement. Phonocardiography. Pulse oximetry. Medical monitors. Electrostimulation and electrosurgery medical devices. Therapeutic medical devices. Implantable medical devices. Telemetry. Medical devices for audiology.

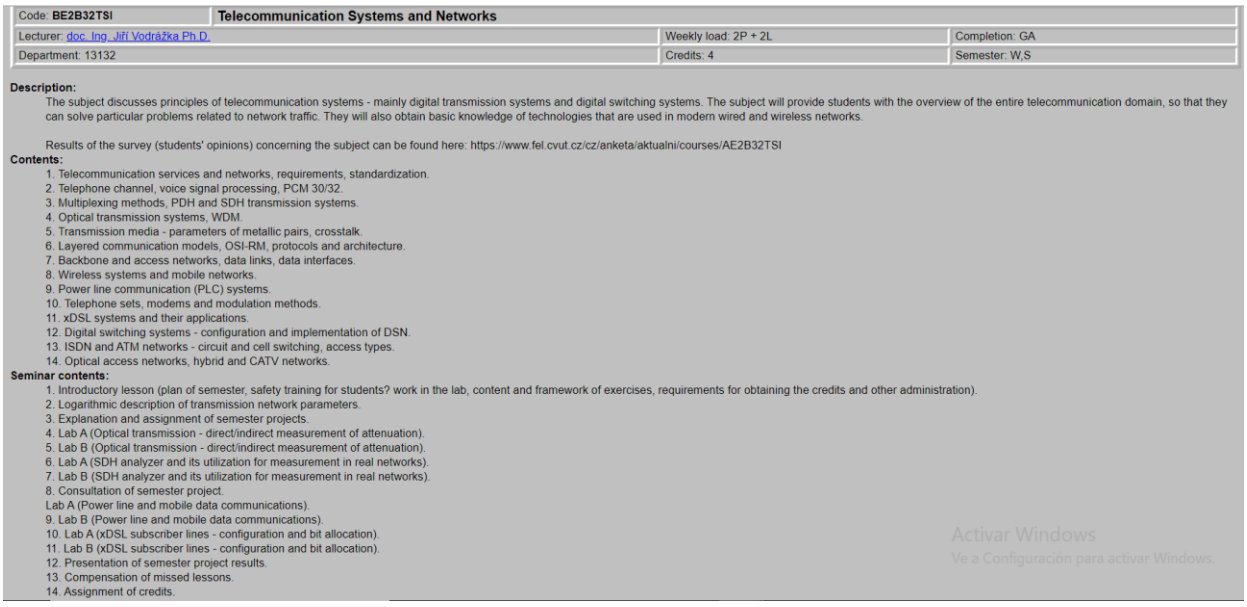
Contents:

1.Introduction. Medical devices categories
2.Biopotential amplifiers, sensing electrodes
3.Electromyography (EMG)
4.Blood pressure measurement (methods and devices)
5.Electrocardiography (ECG)
6.Vital signs monitoring
7.Pneumometry (spirometer, pneumotachograph, body composition)
8.Holter monitors
9.Electroencephalogram (EEG)
10.Medical devices for audiology, ophthalmology, optometry and videoculography
11.Diagnostic ultrasound system
12.Dilution methods, cardiotachography, phonocardiography
13.Pulse oximetry
14.Electrical safety of medical devices

Seminar contents:

1.Educational videoprogrammes
2.Biopotential amplifiers, electrodes measurement
3.Electromyography (EMG)
4.Vital signs monitors
5.Blood pressure measurement.
6.Electrocardiography (ECG)
7.Phonocardiography (FCG)
8.Pulse oximetry
9.Electroencefalograph (EEG + biofeedback)
10.Infusion pumps
11.Therapeutic ultrasound system and magnetotherapeutic system
12.Dilution methods
13.Spirometer
14.Electrical safety and calibration of medical devices

Telecommunications systems and Networks (4) = Telecomunicaciones (4). *(Faculty of Electrical Engineering)*



Code: BE2B32TSI	Telecommunication Systems and Networks	
Lecturer: doc. Ing. Jiří Vodrážka Ph.D.	Weekly load: 2P + 2L	Completion: GA
Department: 13132	Credits: 4	Semester: W,S

Description:

The subject discusses principles of telecommunication systems - mainly digital transmission systems and digital switching systems. The subject will provide students with the overview of the entire telecommunication domain, so that they can solve particular problems related to network traffic. They will also obtain basic knowledge of technologies that are used in modern wired and wireless networks.

Results of the survey (students' opinions) concerning the subject can be found here: https://www.fel.cvut.cz/cz/anketa/aktualni/courses/AE2B32TSI

Contents:

1. Telecommunication services and networks, requirements, standardization.
2. Telephone channel, voice signal processing, PCM 30/32.
3. Multiplexing methods, PDH and SDH transmission systems.
4. Optical transmission systems, WDM.
5. Transmission media - parameters of metallic pairs, crosstalk.
6. Layered communication models, OSI-RM, protocols and architecture.
7. Backbone and access networks, data links, data interfaces.
8. Wireless systems and mobile networks.
9. Power line communication (PLC) systems.
10. Telephone sets, modems and modulation methods.
11. xDSL systems and their applications.
12. Digital switching systems - configuration and implementation of DSN.
13. ISDN and ATM networks - circuit and cell switching, access types.
14. Optical access networks, hybrid and CATV networks.

Seminar contents:

1. Introductory lesson (plan of semester, safety training for students? work in the lab, content and framework of exercises, requirements for obtaining the credits and other administration).
2. Logarithmic description of transmission network parameters.
3. Explanation and assignment of semester projects.
4. Lab A (Optical transmission - direct/indirect measurement of attenuation).
5. Lab B (Optical transmission - direct/indirect measurement of attenuation).
6. Lab A (SDH analyzer and its utilization for measurement in real networks).
7. Lab B (SDH analyzer and its utilization for measurement in real networks).
8. Consultation of semester project.
Lab A (Power line and mobile data communications).
9. Lab B (Power line and mobile data communications).
10. Lab A (xDSL subscriber lines - configuration and bit allocation).
11. Lab B (xDSL subscriber lines - configuration and bit allocation).
12. Presentation of semester project results.
13. Compensation of missed lessons.
14. Assignment of credits.

Nanotechnology (4). *(Faculty of Electrical Engineering)*

Code: **BE0B13NNT**	**Nanotechnology**	
Lecturer: doc. Ing. Pavel Ctibor Ph.D.	Weekly load: 2P+2L	Completion: A, EX
Department: 13113	Credits: 4	Semester: W,S

Description:

The course is under way of essential convergence of the nano-bio-info fields in nanoscale. The lectures are focused on the characterization of nanostructures, growth of fractals and nanostructures and self-assembly of nanostructures, top-down and bottom-up processes, nanomaterials like nanotubes and graphene, application in nano-electro-mechanical systems, new materials, medicine, new sources of energy, and bio-inspired nano-structures like atificial tissues.

Contents:

1 Introduction
2 Diagnostics of nanostructures
3 Fractals, diffusion limited aggregation
4 Physics of colloids
5 Application of colloids physics in NNT
6 Carbon nanomaterials
7 Nanomaterials
8 Inorganic nanomaterials
9 Plasma physics
10 Sparking plasma sintering
11 Vertical morphology of nanostructures
12 Horizontal nanostructures
13 Nanoelectronics
14 DNA, Biomimetics, Drag targeted transport

Seminar contents:

1 Introduction
2 Optical and atomic force microscopy (AFM)
3 Synthesis and structure of polymers
4 Properties of polymers
5 Polymer nano-composites
6 Thin layers physics
7 Thin layers technology
8 Diagnostics of el. properties of layers
9 Growth of spherolits from polymer melt
10 Epitaxial growth
11 Lithography
12 Excursion
13 Growth of fractals
14 Test in exercises, Credits