University of Debrecen
Centre of Arts, Humanities and Sciences
Hungary

Faculty of Science
Electrical Engineering, BSc Program
## CURRICULUM

### ELECTRICAL ENGINEERING

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
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### Core Module (44 credits)

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<td>Computer Architectures</td>
<td>2/0/3/e</td>
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<td>TMBE0141</td>
<td>Introduction to Chemistry</td>
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### Economics and Human Knowledge (18 credits)

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<td>Fundamentals of Environmental Science</td>
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<tr>
<td>TFBE1108</td>
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<td>2/0/0/e</td>
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<tr>
<td>TFBE1109</td>
<td>Introduction to the EU</td>
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<tr>
<td>TFBE1110</td>
<td>Fundamentals of Civil Law</td>
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<td>TFBE1111</td>
<td>Economics of Enterprises</td>
<td>4/0/0/e</td>
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<td>TFBE1112</td>
<td>Intellectual Property Protection</td>
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### Advanced Professional Module (89 credits)

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<td>Programming 1</td>
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<tr>
<td>TFBE1202</td>
<td>Programming 2</td>
<td>2/4/0/e</td>
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<td>TFBE1203</td>
<td>Measurement and Instrumentation 1</td>
<td>2/0/3/e</td>
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<td>TFBE1204</td>
<td>Measurement and Instrumentation 2</td>
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<td>TFBE1205</td>
<td>Electricity</td>
<td>4/2/0/e</td>
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<td>TFBE1206</td>
<td>Networks and Systems</td>
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<td>TFBE1207</td>
<td>Electronics 1</td>
<td>3/1/0/e</td>
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<td>TFBE1209</td>
<td>Digital Electronics 1</td>
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<td>Digital Electronics 2</td>
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<td>TFBE1215</td>
<td>Microelectronics</td>
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<td>TFBE1217</td>
<td>Production and Quality Management</td>
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### Optional Professional Subjects (49 credits)

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<td>Theoretical subjects of the specialization</td>
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<td>0/0/3/p</td>
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<td>TFBL1403</td>
<td>Stand-alone laboratory 1</td>
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<td>TFBL1404</td>
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<td>Thesis 2</td>
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### Free Optional Subjects (10 credits)

<table>
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<td>TFBL1402</td>
<td>Free-selected subject 2</td>
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<tr>
<td>TFBL1403</td>
<td>Sport</td>
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### Hours per week

- Total credits: 30
- Examinations: 6
- Hours per week: 28

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a/b/c/d/f - lecture/practical/laboratory/examination form (e – examination; p – practical grade; s – signature)/credits
# ELECTRICAL ENGINEERING

## ELECTRICAL ENGINEERING, INFOTECHNOLOGY SPECIALIZATION

**Responsible:** Dr. Sándor Kökényesi

<table>
<thead>
<tr>
<th>Term</th>
<th>Code</th>
<th>Subject</th>
<th>Credits</th>
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<tbody>
<tr>
<td>1. Infotechnology specialization</td>
<td>TFBE1601</td>
<td>Photonics</td>
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<td>TFBE1602</td>
<td>Nanotechnology</td>
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<td>TFBE1603</td>
<td>Nanoelectronics</td>
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<td>TFBE1604</td>
<td>Digital Signal Processing</td>
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<td>TFBE1605</td>
<td>Complex Design of Digital Systems</td>
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<td>TFBE1606</td>
<td>Materials Science Fundamentals of Information Technology</td>
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## ELECTRICAL ENGINEERING, AUTOMATION SPECIALIZATION

**Responsible:** Dr. Sándor Misák

<table>
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<th>Term</th>
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<tbody>
<tr>
<td>2. Automation specialization</td>
<td>TFBE1701</td>
<td>Electrical Machines and Drives</td>
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<tr>
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<td>TFBE1702</td>
<td>Computer Controlled Measurement and Process Control</td>
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<td>TFBE1703</td>
<td>Identification and Control Systems</td>
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<td>TFBE1704</td>
<td>Programmable Logic Controllers (PLC)</td>
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<td>TFBE1705</td>
<td>Power Electronics</td>
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<td>TFBE1706</td>
<td>Sensors and Actuators</td>
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<td>TFBL1401</td>
<td>Stand-alone laboratory 1</td>
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## FREE OPTIONAL SUBJECTS

<table>
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<tr>
<td>Free Optional Subjects</td>
<td>TFBE1501</td>
<td>Energy Sources</td>
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<td>TFBE1502</td>
<td>Magnetic Materials</td>
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<td>TFBE1503</td>
<td>Application of Microcontrollers</td>
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<td>TFBE1504</td>
<td>Interfaces</td>
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<td>TFBE1506</td>
<td>Nuclear Electronics</td>
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<td>TFBE1507</td>
<td>Applied Electronics</td>
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<td>TFBE1508</td>
<td>Digital Image Engineering</td>
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<td>TFBE1509</td>
<td>Property Protection and Alarm Systems</td>
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<td>TFBE1510</td>
<td>Robotics</td>
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DESCRIPTION OF SUBJECT PROGRAM

Subject: TMBE0603 Mathematics 1
Classes/week: 4 hour lecture, 2 hour seminar
ECTS Credit Points: 5
Prerequisites: -
Lecturer: Péter T. Nagy, DSc


Compulsory/Recommended Readings:

Subject: TMBE0604 Mathematics 2
Classes/week: 4 hour lecture, 2 hour seminar
ECTS Credit Points: 6
Prerequisites: TMBE0603 Mathematics 1
Lecturer: Péter T. Nagy, DSc


Compulsory/Recommended Readings:

Subject: TMBE0605 Mathematics 3
Classes/week: 4 hour lecture, 2 hour seminar
ECTS Credit Points: 6
Prerequisites: TMBE0604 Mathematics 2
Lecturer: Péter T. Nagy, DSc


Compulsory/Recommended Readings:
**Subject: TFBE1101 Physics 1**
Classes/week: 3 hour lecture, 1 hour seminar
ECTS Credit Points: 5
Prerequisites: None
Lecturer: András Demény, PhD; Darai, PhD; Ferenc Cserpák, PhD


**Compulsory/Recommended Readings:**
Halliday, Resnick, Krane: Physics, John Wiley & Sons Inc.
Sears, Zemansky, Young: University Physics, Addison-Wesley Publishing Company.

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**Subject: TFBE1102 Physics 2**
Classes/week: 3 hour lecture, 1 hour seminar
ECTS Credit Points: 5
Prerequisites: TFBE1101 Physics 1, TMBE0603 Mathematics 1
Lecturer: Prof. Dr. József Pál linkás; Imre Szalóki, PhD

The properties and structure of the atomic nuclei. Nuclear models. Nuclear fission and fusion. Energy from the nuclei, nuclear reactors. Elementary particles and fundamental interactions. The basic principles of cosmology.

**Compulsory/Recommended Readings:**
Halliday, Resnick, Krane: Physics, John Wiley & Sons Inc.
Sears, Zemansky, Young: University Physics, Addison-Wesley Publishing Company.

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**Subject:** TFBE1103 Materials Science for Electrical Engineering  
**Classes/week:** 3 hour lecture, 1 hour seminar  
**ECTS Credit Points:** 5  
**Prerequisites:** None  
**Lecturer:** Sándor Kökényesi, DSc


**Compulsory/Recommended Readings:**

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**Subject:** TFBE1104 Introduction to Informatics  
**Classes/week:** 2 hour lecture, 2 hour laboratory  
**ECTS Credit Points:** 4  
**Prerequisites:** None  
**Lecturer:** András Bölcskei, PhD; Dr. habil Sándor Sudár, PhD

**The goal of the course:** to give to the students basic knowledge on computer usage and to lay the foundation for admission possibility of further subjects.

**Topics:** Computer as information-processing machine. Computer-architectures. Fundamental concepts of informatics (data, program, compiler, interpreter, programming, operating system, basic software, system software, application software, bit, byte, compatibility, syntax, semantics, programming languages, word- and table-processors, database management systems). Peripheral devices, their usage. Basic concepts of operating system. Concept, characteristics and specification modes of algorithm. Radix number systems, conversion rules. Information presentation in computers (address, presentation and operation performing with logic, numerical and textual data, presentation of programs). Basic principals of CPU function. Programming of computers. Basic principals of machine language programming. Assembly and high level languages. Basic algorithms (sort, search, merge). Basic concepts of computer networks. Development steps of computer systems. During practical classes the students will become familiar with the main elements of one operation system, one user interface and one word processor.

**Compulsory/Recommended Readings:**
Subject: TFBE1105 Computer Architectures  
Classes/week: 2 hour lecture, 3 hour laboratory  
ECTS Credit Points: 5  
Prerequisites: TFBE1104 Introduction to Informatics  
Lecturer: Sándor Misák, PhD

The goal of the course: Students acquaint with PC, more complex computer systems and with physical and mathematical fundamentals of basic hardware devices, become familiar with CPU-around computer units (memory, main peripherals), look in their structure and function basics, obtain knowledge in computer organizational hierarchy and the future of computer hardware.


Compulsory/Recommended Readings:  

Subject: TTBE0141 Introduction to Chemistry  
Classes/week: 2 hour lecture  
ECTS Credit Points: 3  
Prerequisites: None  
Lecturer: Sándor Kéki, PhD

The goal of the course is to give a basic knowledge in general and inorganic chemistry for advanced studies.


Compulsory/Recommended Readings:  

Subject: TFBE0040 Fundamentals of Environmental Science  
Classes/week: 1 hour lecture, 1 hour seminar  
ECTS Credit Points: 2  
Prerequisites: None  
Lecturer: Gyula Lakatos, PhD

Aim: Students can acquire the basic terms and gain insight into the sub-fields of environmental science; the presentation of the most important tasks of environmental protection
**Topics:** The definition and the elements of the environment. Man and his environment. Inter-, multi- and transdisciplinary characteristics of environmental science. The history of human activity on the environment, its effects and consequences, the environmental crisis. The definition and scope of environmental protection. The history of environmental protection and conservation, global problems of the environment. The elements of natural environment, the ground, the waters and the atmosphere. Organization of living resources, basic ecology. The evolution of the biosphere, human population. System-based approach in environmental science. Environmental resources and their protection. Environmental conferences, the message of Rio and its documents. Agenda 21, the conclusions of Johannesburg and their aspects in Hungary. Environmental pollution and its effect, environmental protection as a human-centered social activity. Ecological approach focusing on life, the principles of sustainable development in environmental protection

**Compulsory/Recommended Readings:**

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Subject: TFBE1108 Economics  
Classes/week: 2 hour lecture  
ECTS Credit: Points: 3  
Prerequisites: None  
Lecturer: Imre Egri, PhD

**Aim:** To introduce students to the basic context and terminology of economy at macro- and micro level, so that they become able to realize economic processes and relationships.  

**Compulsory/Recommended Readings:**

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Subject: TFBE1109 Introduction to the EU  
Classes/week: 2 hour lecture  
ECTS Credit: Points: 3  
Prerequisites: None  
Lecturer: István Suli-Zakar, DSc

**Aim:** After the introduction of the integration theory, students gain insight into the history of the EU and its role in world economy.  
**Topics:** Institutions of the EU and the reform processes. Enlargement, the peculiarities of the fifth round of enlargement. Hungary in the EU

**Compulsory/Recommended Readings:**
**Subject: TFB/E1110 Fundamentals of Civil Law**

*Classes/week: 2 hour lecture*  
*ECTS Credit: Points: 3*  
*Prerequisites: None*  
*Lecturer: György Csécsy, PhD*

**Aim:** To introduce students to the basic rules of civil law, which is part of our every day life, and to the basic institutions of civil substantive law

**Topics:**  
Conditions of civil liability. General rules, special responsibility patterns.

**Compulsory/Recommended Readings:**


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**Subject: TFB/E1111 Economics of Enterprises**

*Classes/week: 4 hour lecture*  
*ECTS Credit: Points: 4*  
*Prerequisites: TFB/E1108 Economics*  
*Lecturer: Imre Egri, PhD*

**Aim:** Introduction to the operation of enterprises in practice. Preparation of investments, registration, business planning.

**Topics:**  
Registration, book-keeping.  
Making business plans.

**Compulsory/Recommended Readings:**


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**Subject: TFB/E1112 Intellectual Property Protection**

*Classes/week: 2 hour lecture, 1 hour seminar*  
*ECTS Credit: Points: 3*  
*Prerequisites: TFB/E1110 Fundamentals of Civil Law*  
*Lecturer: Imre Mojzes, DSc*

**Aim:** The course provides an introducing to the filed of intellectual property rights, know-how, patents, copyright issues from the perspective of the engineering profession.

**Topics:**  
The basics of intellectual property rights from the perspective of an enginer: managing ones own intellectual properties. Basic documents and laws related to intellectual properties. Industrial property, which includes inventions (patents), trademarks. The usage of intellectual property related database. International law related to industrial intellectual property protection: PCT and the European union. The special aspects of software related intellectual properties in Hungarian and international perspective.
Compulsory/Recommended Readings:


Subject: TFBE1201 Programming 1
Classes/week: 2 hour lecture, 4 hour seminar
ECTS Credit Points: 6
Prerequisites: None
Lecturer: Sándor Misák, PhD; Ferenc Kun, PhD

The goal of the course: Students acquaint with C programming language, become familiar with basic algorithms and programming techniques.


Compulsory/Recommended Readings:


Subject: TFBE1202 Programming 2
Classes/week: 2 hour lecture, 4 hour seminar
ECTS Credit Points: 6
Prerequisites: TFBE1201 Programming 1
Lecturer: Sándor Misák, PhD; Ferenc Kun, PhD

The goal of the course: Students acquaint with C++ programming language.


Compulsory/Recommended Readings:


Subject: TFBE1203 Measurements and Instrumentation 1
Classes/week: 2 hour lecture, 3 hour laboratory
ECTS Credit Points: 5
Prerequisites: TFBE1101 Physics 1
Lecturer: Dr. Imre Szalóki, PhD; Dr. Ferenc Cserpák, dr. univ.

Topics: Introduction to the measurement and instrumentation, models and modeling. International System of Units (SI). Methods and uncertainties of the measurements; general structure of the instruments; current and voltage measurements; different type of the current and voltage measurement (integrating DC measurement, absolute, RMS, vector, selective measurement equipments). Signal processing and noise. Signal transducers (RLC circuits, dividers, PWM divider, etc.). Measurement amplifiers, rectifiers, RMS-transducers, sampling and hold units, DA and AD converters. Digital multimeters.

Compulsory/Recommended Readings:

Subject: TFBE1204 Measurements and Instrumentation 2
Classes/week: 2 hour lecture, 3 hour laboratory
ECTS Credit Points: 5
Prerequisites: TFBE1203 Measurements and Instrumentation 1
Lecturer: Dr. Imre Szalóki, PhD; Dr. Ferenc Cserpák, dr. univ.

Topics: Power and energy measurements; determination of impedances; time and frequency measurements; sources and loads; signal analyzers; calibration of the instruments. Computer controlled measurements; unified connection systems; data transfer modes between the computers and measuring equipment, communication procedures; programming languages, programming tools.

Compulsory/Recommended Readings:

Subject: TFBE1205 Electricity
Classes/week: 4 hour lecture, 2 hour seminar
ECTS Credit Points: 6
Prerequisites: TMBE0604 Mathematics 2, TFBE1102 Physics 2
Lecturer: Dr. habil Sándor Sudár; Endre Takács, PhD

Purpose: In depth study of the laws of Electrodynamics previously introduced in Physics 2. Selected subjects related to the profession of Electrical Engineering.

Topics: Basic laws of electrodynamics, electric charge, electric current, field quantities. Differential and integral forms of the Maxwell equations. The division of electrodynamics according to the Maxwell equations. Static and stationary fields. Electric potential, Poisson equation, electric field of a dipole. Electrostatics of conductors, capacitors, energy stored in capacitors. Continuity equation, differential and integral forms of Ohm's law, Kirchoff's

**Compulsory/Recommended Readings:**


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**Subject:** TFBE1206 Networks and Systems  
**Classes/week:** 4 hour lecture, 2 hour seminar  
**ECTS Credit Points:** 6  
**Prerequisites:** TMBE0605 Mathematics 3  
**Lecturer:** Dr. habil Sándor Sudár; Endre Takács, PhD, Sándor Egri

**The goal of the course:** The course provides the basic idea and calculation methods of the networks and system with concentrated elements.


**Compulsory/Recommended Readings:**


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**Subject:** TFBE1207 Electronics 1 (Electronic Devices)  
**Classes/week:** 3 hour lecture, 1 hour seminar  
**ECTS Credit Points:** 5  
**Prerequisites:** TFBE1102 Physics 2  
**Lecturer:** Sándor Misák, PhD

**The goal of the course:** Students acquaint with structure, function and application areas of electronic devices.

**Topics:** electronics definition, devices categories, passive and active, linear and non-linear, vacuum and solid-state devices definition. Fundamentals of semiconductor electronic devices function on the basis of band structure theory. Conduction mechanisms, work function of metals, thermo- and photoelectric emission in vacuum. Passive elements: conductors, resistors, temperature-dependent effects, thermistors, varistors, capacitors, coils, transformers. Passive

Compulsory/Recommended Readings:

Subject: TFBE1208 Electronics 2 (Analog Electric Circuits)
Classes/week: 3 hour lecture, 2 hour laboratory
ECTS Credit Points: 5
Prerequisites: TFBE1207 Electronics 1.
Lecturer: Imre Zolomy, DS; Sándor Misák, PhD; Lajos Harasztosi

The goal of the course: Students acquaint with structure, function, characteristics of some important analog circuits.

Compulsory/Recommended Readings:

Subject: TFBE1209 Digital Electronics 1
Classes/week: 3 hour lecture, 2 hour seminar
ECTS Credit Points: 5
Prerequisites: TFBE1202 Programming 2
Lecturer: Gyula Zillí, PhD; Sándor Misák, PhD

The goal of the course: Students acquaint with structure, function, characteristics, design of some important digital circuits.

Compulsory/Recommended Readings:

Subject: TFBE1210 Digital Electronics 2
Classes/week: 2 hour lecture, 4 hour laboratory
ECTS Credit Points: 5
Prerequisites: TFBE1209 Digital Electronics 1
Lecturer: Gyula Zilíži, PhD; Sándor Misák, PhD

The goal of the course: Students acquaint with some integrated digital circuit family, D/A and A/D converters, microprocessors and microcontrollers, design and simulation of digital circuits.


Compulsory/Recommended Readings:

Subject: TFBE1211 Electronic Technology
Classes/week: 3 hour lecture, 2 hour laboratory
ECTS Credit Points: 5
Prerequisites: TFBE1103 Materials Science for Electrical Engineering
Lecturer: Sándor Kükényesi, DSc


Compulsory/Recommended Readings:
Subject: TFBE1212 Automation 1
Classes/week: 3 hour lecture, 1 hour seminar
ECTS Credit Points: 5
Prerequisites: TFBE1202 Programming 2, TMBE0605 Mathematics 3
Lecturer: Ruth Bars, PhD; István Bézi, dr. univ.

The goal of the course: Presenting the continuous time linear control systems, its analysis and synthesis.

Topics: The concept of control, systems and signals. The classification of signals. Control structures, regulation and control, compensation of disturbances. The structure of an automation control system. Examples, Main requirements of a control system.

The signal transfer properties of a feedback system. Composite transfer system types, base signal following and noise compensation. Stability analysis and the Nyquist stability criterion. Quality parameters of a regulatory system and their estimates base on the properties of the frequency space representation.


Experimental setup of control systems. The Ziegler-Nicholson and the Oppelt method.

Computer based laboratory practices based on the MATLAB/SIMULINK program. Demonstration programs, solving control system analysis and synthesis problems.

Compulsory/Recommended Readings:

Subject: TFBE1213 Automation 2
Classes/week: 3 hour lecture, 1 hour seminar
ECTS Credit Points: 5
Prerequisites: TFBE1212 Automation 1
Lecturer: Ruth Bars, PhD; István Bézi, dr. univ.

The goal of the course: Presenting discrete linear and nonlinear systems, synthesis and analysis.

Optimal, adaptive and robust control systems.

Computer based laboratory practices based on the MATLAB/SIMULINK program. Demonstration programs, solving control system analysis and synthesis problems.
Compulsory/Recommended Readings:

Subject: TFBIE1214 Telecommunication
Classes/week: 3 hour lecture, 1 hour seminar
ECTS Credit Points: 4
Prerequisites: TFBIE1205 Electricity
Lecturer: József Molnár, PhD; István Szabó, PhD

The goal of the course: Introducing the most fundamental concepts of telecommunication systems, the theoretical foundation of their methods, and the development of the corresponding competences.


Compulsory/Recommended Readings:

Subject: TFBIE1215 Microelectronics
Classes/week: 3 hour lecture, 2 hour seminar
ECTS Credit Points: 6
Prerequisites: TFBIE1103 Materials Science for Electrical Engineering
Lecturer: Imre Mojzes, DSc

The goal of the course: Students acquaint with structure, manufacturing and test of integrated circuits (ICs) made by different technology.


Compulsory/Recommended Readings:
Subject: TFBE1216 Electric Power Systems  
Classes/week: 3 hour lecture, 2 hour seminar  
ECTS Credit Points: 5  
Prerequisites: TFBE1205 Electricity  
Lecturer: Lajos Daróczi, PhD; Béla Lőrincz

The goal of the course: To give fundamentals for the students about the production, transmission and distribution of the electric energy. Understanding operation and control of electric power systems.


Compulsory/Recommended Readings:  

Subject: TFBE1217 Production and Quality Management  
Classes/week: 2 hour lecture, 3 hour laboratory  
ECTS Credit Points: 5  
Prerequisites: TFBE1215 Microelectronics  
Lecturer: Imre Mojzes, DSc

The goal of the course: The description of industrial production processes and their relation to quality control. Introduction of the applicable ISO standards and their applications.

Topics: Experimental and full scale production methods. Sequential and parallel production techniques. Specific elements of the electronic industrial production. Logistics and production organization issues. Methods of documentation. Industrial production and standards. The ISO 9000 and ISO 14000 standard series on the example of electronic manufacturing. Green electronics. During the practice periods, the students get acquainted with the standard practices at the National Instruments Factory especially with the steps related to quality control, application of automated test methods, laboratory techniques for product quality assessments (microscopic techniques, enhanced aging test etc.).

Compulsory/Recommended Readings:  

Subject: TFBE1601 Photonics  
Classes/week: 2 hour lecture, 2 hour laboratory  
ECTS Credit Points: 4  
Prerequisites: TFBE1215 Microelectronics  
Lecturer: Imre Mojzes, DSc; Sándor Kókényesi, DSc; Sándor Misák, PhD

The goal of the course: Students acquaint with photonic materials, devices and some application aspects (optical communication, measurement technology, medical equipment).

Compulsory/Recommended Readings:

Subject: TFB1602 Nanotechnology
Classes/week: 3 hour lecture
ECTS Credit Points: 4
Prerequisites: TFB1215 Microelectronics
Lecturer: Dézső Beke, Prof.

Aim: To show and illustrate the meaning and content of nanophysics, nanotechnics and nanotechnology. Describe the basics of most important nanotechnologies, those nanoscale processes on which the present and future technologies are based.


Compulsory/Recommended Readings:

Subject: TFB1603 Nanoelectronics
Classes/week: 3 hour lecture
ECTS Credit Points: 4
Prerequisites: TFB1215 Microelectronics
Lecturer: Sándor Kökényesi, DSc


Compulsory/Recommended Readings:
MATÁV and MTA Nanotechnology symposia (CD).
Subject: TFB1604 Digital Signal Processing and DSP processors
Classes/week: 1 hour lecture, 2 hour laboratory
ECTS Credit Points: 3
Prerequisites: TFB1206 Networks and systems
Lecturer: István Szabó, PhD

The goal of the course: The course is introducing the basics of real time digital signal processing techniques with implementations on DSP processors.

Topics: DSP algorithms: Linear systems, Fourier series and Fourier transformation, Convolution and deconvolution, A/D converters, Digital filters, DFT-FFT, signal encoding and compression, DPS processors: typical architectures, addressing modes, instruction sets, memory models. Real time signal processing with DSP processors. In the laboratory practices DSK sets are used to implement example problems: Introducing the programming environment, A/D-D/A conversion, FIR and IIR filter implementation and measurement, real time data compression: coding and decoding.

Compulsory/Recommended Readings:
http://www.dspstore.com
Texas Instruments manuals: http://www.ti.com
Smith S. W.: The Scientists and engineers guide to Digital Signal processing (http://www dspguide.com).

Subject: TFB1605 Complex Design of Digital Systems
Classes/week: 2 hour lecture, 1 hour seminar
ECTS Credit Points: 4
Prerequisites: TFB1212 Automation I
Lecturer: Dr. habil István Ajtongyí

The goal of the course: Students master complex, EMC-focused design methods of electronic devices and apparatuses.


Compulsory/Recommended Readings:

Subject: TFB1606 Materials Science Fundamentals of Information Technology
Classes/week: 2 hour lecture
ECTS Credit Points: 3
Prerequisites: TFB1215 Microelectronics
Lecturer: Imre Mojzes, DSc

The goal of the course is to give an overview on materials and technologies used in info-communication devices and gears.
Topics: Wide range of materials from complex multilayer compound semiconductors to paper is used in IT devices. Parameters of these materials are usually the best because of used high-quality technology. Fast function rate, system complexity make high demands not only to the reliability of discrete elements but also to the technology. Besides the ergonomic aspects are also important for example in printing, displaying and sometimes in implementation of displays. Lectures acquaint with the fundamentals of above-mentioned materials and technologies.

Compulsory/Recommended Readings:

Subject: TFBE1701 Electrical Machines and Drives
Classes/week: 2 hour lecture, 2 hour laboratory
ECTS Credit Points: 4
Prerequisites: TFBE1205 Electricity
Lecturer: Lajos Daróczi, PhD

The goal of the course: introducing students to the fundamentals of transformers, electric engines and propulsion systems. Understanding operation, control and service of these equipments.


Compulsory/Recommended Readings:

Subject: TFBE1702 Computer Controlled Measurement and Process Control
Classes/week: 2 hour lecture, 1 hour laboratory
ECTS Credit Points: 4
Prerequisites: TFBE1213 Automation 2
Lecturer: Dr. habil Sándor Sudár; Gyula Zilizi, PhD; László Oláh, PhD; Zoltán Szillási

The goal of the course: The course provides the basic idea of the computer controlled measurement and control.

Topics: Structure of measuring systems, basic elements of the measuring system. Evolution of the computer controlled measurements. Unified connection systems (CAMAC, IEC, etc.). Data transfer modes between the computers and measuring equipment, communication procedures. Computer operation systems and their effect on measurements. Realization of the computer controlled measurements in different programming languages, programming tools. Basics of the process control, type of the control systems. Processes control by computer. Examples for real measuring and process controller systems. Fuzzy logic, neural networks and theirs application in the process control.

Exercises: Introduction to LabVIEW, LabVIEW Virtual Instruments, Creating, Editing, and Debugging a VI, Creating a SubVI, Loops and Charts, Arrays, Graphs and Clusters, (Creating arrays, Waveform and XY Graphs), Case and Sequence Structures, Formula and Expression Nodes, Strings and File I/O (Build String VI, File I/O VIs and Functions, Formatting Spreadsheet Strings); Data Acquisition and Waveforms (Data Acquisition (DAQ) Overview, Organization of Data Acquisition VIs, Performing a Single Analog Input), DAQ Wizards, Waveform Analog Input, Writing Waveform Data to File, Scanning Multiple Analog Input Channels, Analog Output, Digital Input and Output, Counters; Instrument Control Overview, GPIB Communication and Configuration.
Exercise for the I/O port handling. Making a computer controlled function generator by the D/A converters, amplitude and frequency control; Play back of digitally stored sound using D/A converter.

Compulsory/Recommended Readings:

Subject: TFBF1703 Identification and Control Systems
Classes/week: 2 hour lecture, 1 hour laboratory
ECTS Credit Points: 4
Prerequisites: TFBF1212 Automation 1
Lecturer: Károly Szandtner, dr. univ.; Sándor Misák, PhD

The goal of the course: practical mastering with the structure and functioning principles, design and application of identification systems.

Topics: Devices suitable for invocation, reading and/or writing of data carriers. Some typical application examples on demonstration of identification and control systems. Identification and control systems based on emitting and measurement of optical signals. Application of loop-control implemented on power circuit for identification. Application of long-wave radiofrequency receiver-transmitter systems for identification and control purposes. Safeguarding equipments and systems. Fire-alarm equipments. Structure of building-informatics systems.

Compulsory/Recommended Readings:

Subject: TFBF1704 Programmable Logic Controllers
Classes/week: 2 hour lecture, 2 hour laboratory
ECTS Credit Points: 4
Prerequisites: TFBF1702 Computer Controlled Measurement and Process Control
Lecturer: István Kocsis, dr. univ.; István Bartha

The goal of the course: Students master implementation of industry control by programmable logic controllers (PLCs).

Topics: Tasks of compact and modular controller installation. Presentation of some specific PLCs. The structure, classification, function model of PLCs. Programming languages, current-path project, block language, flow-diagram language. Implementation of current-path project, sequential network and flow-diagram implementation by relay description. PLCs with modular structure. Design aspects, methods and steps. PLCs with high reliability, self-test, debugging and error correction (erase) methods. Aspects of program development. Structure and functions of developing systems. Programming and possibility of program portability. PLCs buses and sensor buses.

Topics of laboratory: Practical presentation of some programming device structure, and hardware installation problems. Programming with ladder-diagram. Function block programming. Presentation of input attached sensors and output attached actuators problems. Entire control system development. Presentation of GSM communication possibilities. Programming and development of MODBUS communication systems.
Compulsory/Recommended Readings:

Subject: TFBEE1705 Power Electronics
Classes/week: 2 hour lecture
ECTS Credit Points: 3
Prerequisites: TFBEE1701 Electrical Machines and Drives
Lecturer: Kárpáti Attila, PhD; Lajos Daróczi, PhD

The goal of the course: introduction to the components and circuit solutions of power electronics.


Compulsory/Recommended Readings:

Subject: TFBEE1706 Sensors and Actuators
Classes/week: 2 hour lecture, 1 hour laboratory
ECTS Credit Points: 3
Prerequisites: TFBEE1210 Digital Electronics 2
Lecturer: Imre Szalóki, PhD; István Bartha

The goal of the course: To study systematically the sensor based measuring technologies and related measuring methods. The course provides the metrological properties of the measuring systems using sensors, the evaluation methods of measured data sets and practical experience in application of sensors.


Compulsory/Recommended Readings:

Subject: TFBIE1501 Energy Sources
Classes/week: 2 hour lecture
ECTS Credit points: 2
Prerequisite: TFBIE1102 Physics 2
Lecturer: Péter Raics, PhD

Aim of the course: It gives an overall description on the features and utilization of the main energy sources: fossil, nuclear, renewable, alternatives, bio, wastes. Strategies for further development. Effects to the environment.
Economical strategy.


Compulsory/Recommended Readings:

Subject: TFBIE1502 Magnetic materials
Classes/week: 2 hour lecture
ECTS Credit Points: 2
Prerequisites: TFBIE1102 Physics 2, TFBIE1103 Materials Science for Electrical Engineering
Lecturer: Dezső Beke, Prof.

Aim: Introduction to properties of technical magnetic materials. Provide knowledge on the applications of magnetic materials from the transformer sheets across the relays, filters to the nanomagnetic devices (data recording materials and spin-valve systems).


Compulsory/Recommended Readings:
Subject: TFBE1503 Application of Microcontrollers
Classes/week: 1 hour lecture, 2 hour seminar
ECTS Credit Points: 2
Prerequisites: TFBE1202 Programming 2, TFBE1210 Digital Electronics 2
Lecturer: Gyula Ziliz, PhD

The goal of the course is student preparation to the proper choice and practical usage of microcontrollers for solving of different tasks.


Compulsory/Recommended Readings:

Subject: TFBE1504 Interfaces
Classes/week: 1 hour lecture, 2 hour seminar
ECTS Credit Points: 2
Prerequisites: TFBE1210 Digital Electronics 2
Lecturer: Lajos Harasztosi

The goal of the course: Basics of computer and peripheral interface protocols and system engineering techniques.

Topics: Data transfer techniques between peripheral and computing units (PC, micro controller, micro processor): serial and parallel protocol, hardware and software considerations with practical examples.(Centronics, GPIB, PXI, SCXI, PCI, RS232, RS422, RS485, IrDa, USB, I C, SPI, CAN, FireWire, FieldPoint).

Compulsory/Recommended Readings:

Subject: TFBE1506 Nuclear Electronics
Classes/week: 2 hour lecture, 1 hour seminar
ECTS Credit Points: 3
Prerequisites: TFBE1208 Electronics 2
Lecturer: László Oláh, PhD; Gyula Ziliz, PhD

Aim of the course: The main objective of the course is to study the operation and the applications of electronic circuits in nuclear measuring devices.

Compulsory/Recommended Readings:

Subject: TFBE1507 Applied Electronics
Classes/week: 1 hour lecture, 2 hour laboratory
ECTS Credit Points: 2
Prerequisites: TFBE1208 Electronics 2
Lecturer: Gyula Zilizl, PhD; László Oláh, PhD


Compulsory/Recommended Readings:
Relevant links on the following web page: www.epanorama.net

Subject: TFBE1508 Digital Image Engineering
Classes/week: 2 hour lecture, 1 hour seminar
ECTS Credit Points: 3
Prerequisites: TFBE1202 Programming 2
Lecturer: Csaba Cserháti, PhD; István Szabó, PhD

The goal of the course: The course is going to provide practical techniques and mathematical principles of image manipulation, processing and machine vision. It will present how to get utmost information of the images provided by cameras or other equipments used in technological applications.


Compulsory/Recommended Readings:
The following documents are available from the NI home page, or from the Institute of Physics’s e-Learning site:

Subject: TFBE1509 Property Protection and Alarm Systems
Classes/week: 2 hour lecture, 1 hour seminar
ECTS Credit Points: 3
Prerequisites: TFBE1209 Digital Electronics 1
Lecturer: Károly Szandtner, dr. univ., Sándor Misák, PhD

The goal of the course: mastering of basic knowledge for solution of technical problems of property protection.

and control of alarm systems.

**Compulsory/Recommended Readings:**

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**Subject: TFBE1510 Robotics**  
**Classes/week: 2 hour lecture**  
**ECTS Credit Points: 2**  
**Prerequisites: TFBE1213 Automation 2**  
**Lecturer: István Szabó, PhD**

**The goal of the course:** Fundamentals of robot construction and control.  

**Compulsory/Recommended Readings:**  