<table>
<thead>
<tr>
<th>No.</th>
<th>Neptun Code</th>
<th>Subjects</th>
<th>Semesters</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. IC</td>
<td>2. IC</td>
</tr>
<tr>
<td>1</td>
<td>NAMAN2SEND</td>
<td>Calculus I</td>
<td>3  2</td>
<td>ex 5</td>
</tr>
<tr>
<td>2</td>
<td>NAMAN2SEND</td>
<td>Calculus II</td>
<td>3  2</td>
<td>pm 6</td>
</tr>
<tr>
<td>3</td>
<td>NAMBS1SEND</td>
<td>Introduction to the Theory of Computing I.</td>
<td>3  2</td>
<td>ex 5</td>
</tr>
<tr>
<td>4</td>
<td>NAMBS2SEND</td>
<td>Introduction to the Theory of Computing II.</td>
<td>3  2</td>
<td>pm 6</td>
</tr>
<tr>
<td>5</td>
<td>NAMBS2SEND</td>
<td>Mathematics Final Exam</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NAMBS3SEND</td>
<td>Applied Probability And Mathematical Statistics</td>
<td>2  2</td>
<td>pm 4</td>
</tr>
<tr>
<td>7</td>
<td>NAMBS3SEND</td>
<td>Basics of Informational Systems</td>
<td>2  2</td>
<td>ex 5</td>
</tr>
<tr>
<td>8</td>
<td>NAMBS4SEND</td>
<td>Applied Probability And Mathematical Statistics</td>
<td>2  2</td>
<td>pm 4</td>
</tr>
<tr>
<td>9</td>
<td>KVEFI1SEND</td>
<td>Physics</td>
<td>2  1</td>
<td>ex 5</td>
</tr>
<tr>
<td>10</td>
<td>KVEFI2SEND</td>
<td>Electrical Engineering</td>
<td>3  1</td>
<td>ex 5</td>
</tr>
<tr>
<td>11</td>
<td>GGTKG0SEND</td>
<td>Economics I-II</td>
<td>3  1</td>
<td>pm 6</td>
</tr>
<tr>
<td>12</td>
<td>GSVVG0SEND</td>
<td>Business Economics</td>
<td>3  1</td>
<td>pm 6</td>
</tr>
<tr>
<td>13</td>
<td>GVTME0SEND</td>
<td>Management</td>
<td>3  1</td>
<td>pm 6</td>
</tr>
<tr>
<td>14</td>
<td>NSTPR3SEND</td>
<td>Programming II</td>
<td>3  2</td>
<td>ex 6</td>
</tr>
<tr>
<td>15</td>
<td>NSTPR3SEND</td>
<td>Programming II</td>
<td>3  2</td>
<td>ex 6</td>
</tr>
<tr>
<td>16</td>
<td>NSTPR3SEND</td>
<td>Programming III</td>
<td>3  2</td>
<td>pm 3</td>
</tr>
<tr>
<td>17</td>
<td>NSTPR3SEND</td>
<td>Modem Programming Language</td>
<td>3  2</td>
<td>pm 3</td>
</tr>
<tr>
<td>18</td>
<td>NSTPR3SEND</td>
<td>Database Management</td>
<td>2  2</td>
<td>pm 3</td>
</tr>
<tr>
<td>19</td>
<td>NSTPR3SEND</td>
<td>Software Engineering I</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>20</td>
<td>NSTPR3SEND</td>
<td>Software Engineering II</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>21</td>
<td>NSTPR3SEND</td>
<td>Technical Final Exam</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>22</td>
<td>NIRIT0SEND</td>
<td>Control Engineering</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>23</td>
<td>NIRIT0SEND</td>
<td>Digital Technology</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>24</td>
<td>NIRIT0SEND</td>
<td>Digital Technology</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>25</td>
<td>NIRIT0SEND</td>
<td>Digital Systems</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>26</td>
<td>NIRIT0SEND</td>
<td>Fundamentals of Computer Architectures I</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>27</td>
<td>NIRIT0SEND</td>
<td>Fundamentals of Computer Architectures II</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>28</td>
<td>NIRIT0SEND</td>
<td>Fundamentals of Computer Architectures III</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>29</td>
<td>NIRIT0SEND</td>
<td>Operating Systems</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>30</td>
<td>NIRIT0SEND</td>
<td>Computer Networks</td>
<td>2  2</td>
<td>ex 4</td>
</tr>
<tr>
<td>No.</td>
<td>Neptun Code</td>
<td>Subjects</td>
<td>Semesters</td>
<td>Prerequisites</td>
</tr>
<tr>
<td>-----</td>
<td>-------------</td>
<td>----------</td>
<td>-----------</td>
<td>--------------</td>
</tr>
<tr>
<td>31</td>
<td>NIRBR1SEND</td>
<td>Introduction into Embedded Systems</td>
<td>2 pm 2</td>
<td>16 23</td>
</tr>
<tr>
<td>32</td>
<td>NIRROSEND</td>
<td>Intelligent Systems</td>
<td>2 pm 4</td>
<td>7 16</td>
</tr>
<tr>
<td>33</td>
<td>NSTV1SEND</td>
<td>Enterprise Information Systems</td>
<td>2 ex 2</td>
<td>58 19 11</td>
</tr>
<tr>
<td>34</td>
<td>NSTV2SEND</td>
<td>Modelling of Business Information Systems</td>
<td>2 pm 2</td>
<td>33</td>
</tr>
<tr>
<td>35</td>
<td>NIRBOSEND</td>
<td>Fundamentals of Informatics Security</td>
<td>2 pm 4</td>
<td>6 30</td>
</tr>
<tr>
<td>36</td>
<td>NSTFNSEND</td>
<td>Formal Languages and Automata</td>
<td>2 ex 2</td>
<td>21 5</td>
</tr>
<tr>
<td>37</td>
<td>NSTDRSEND</td>
<td>Decision Support Systems</td>
<td>2 pm 2</td>
<td>32 21</td>
</tr>
<tr>
<td>38</td>
<td>NIRKTSSEND</td>
<td>Infocommunication Techniques</td>
<td>2 pm 2</td>
<td>80</td>
</tr>
</tbody>
</table>

**Supplementary Subjects**

<table>
<thead>
<tr>
<th>No.</th>
<th>Code</th>
<th>Subject</th>
<th>Semesters</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>GTSTSTNEV</td>
<td>Physical Education I</td>
<td>2 pm</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>GTSTSTNEV</td>
<td>Physical Education II</td>
<td>2 pm</td>
<td></td>
</tr>
</tbody>
</table>

**Common and Optional Subject of Specialisation**

<table>
<thead>
<tr>
<th>No.</th>
<th>Code</th>
<th>Subject</th>
<th>Semesters</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>NAMRISENCP</td>
<td>Basics of Robotics</td>
<td>2 ex 3</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>NAMRIKSENCP</td>
<td>Kinematics and Dynamics of Industrial Robots</td>
<td>2 ex 3</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>NAMRMTSENCP</td>
<td>Robotmechatronics</td>
<td>1 ex 2</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>NAMRITSENCP</td>
<td>Application of Robots</td>
<td>1 ex 2</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>NAMRRTSENCP</td>
<td>Intelligent Robot Systems</td>
<td>1 ex 2</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>NAMRRITSENCP</td>
<td>Robot Control</td>
<td>1 ex 3</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>NAMRRRTSENCP</td>
<td>Mobil Robots</td>
<td>2 ex 3</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>NAMRRTSENCP</td>
<td>Fuzzy Systems in Engineering</td>
<td>2 ex 3</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>NAMRRMSENCP</td>
<td>Basic Mathematical Methods in Engineering</td>
<td>1 ex 2</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>NAMRRMTSENCP</td>
<td>Engineering Calculation Methods</td>
<td>1 ex 2</td>
<td></td>
</tr>
</tbody>
</table>

ex – examination, pm – practice mark, ce – course examination, as - assignement
p - both the subject and the prerequisite can be choosen in the same semester

**BASICS OF NATURAL SCIENCE**

1 Calculus I. NAMAN1SEND  
Dr. Endre Pap full professor

The aim of the course is to bring students coming from different secondary schools to the same level and to introduce them to the bases of one-variable calculus.  
The course material is based on revision of secondary school material, numbers, algebraic formulae, equations and inequalities, functions, graphs of functions, function analysis, elementary functions, trigonometry, sequences and series, limits and continuity of functions, differentiating, numerical and symbolic derivation, applications.
2 Calculus II. NAMAN2SEND
Dr. Endre Pap full professor

The aim of the course is to acquire the basic concepts and techniques of calculus of one- and multi-variable functions according to the international trends and requirements of information specialist training. The course material consists of indefinite and definite integral and its meaning, symbolic and numerical integration, applications, plane- and space curves, differentiation and extrema of multi-variable functions, function series, integration of two-variable functions and its applications, concept of differential equations and solution with symbolic and numerical methods and examples of application.

3 Introduction to the Theory of Computing I. NAMBS1SEND
Dr. János Fodor full professor

The aim of the course is to acquire the basic concepts of analytic geometry and linear algebra which are necessary for students' further studies and for the common applications. The course material includes Cartesian coordinate systems, vectors and vector operations, scalar and vector product, equations of straight lines and planes, linear transformations, matrices and matrix operations, linear independence, rank, inverse matrices and transformations, systems of linear equations and their solution, eigenvectors and eigenvalues.

4 Introduction to the Theory of Computing II. NAMBS2SEND
Dr. János Fodor full professor

The aim of the course is to improve the abilities of students in concept formulation, abstraction, problem solving by means of becoming acquainted with the basic topics of finite mathematics and using them in problem solving and model creation. The course material is the following: sets, set-operations, Boole-algebra, relations, equivalence classes, partial ordering, elements of combinatorics (permutations, combinations), proof by induction, graphs, trees, applications, propositional and predicate logic and algebraic structures.

5 Mathematics Final Exam NAMMS1SEND
Dr. Imre Rudas full professor

A final exam which checks students' comprehensive knowledge of the first year's mathematical subjects, such as calculus, linear algebra, and discrete mathematics.

6 Applied Probability and Mathematical Statistics NAMVS1SEND
Dr. Ágota Cserjés associate professor

The aim of the course is to give an introduction to probability and mathematical statistics, to discuss basic concepts, to develop problem-solving skills; it provides an insight into the possibilities of practical application. The course material contains axioms of probability, conditional probability, Bayes's theorem, independent events, geometrical probability. Discrete and continuous random variables, discrete and continuous distributions. Error estimation, Bernoulli’s theorem, central limit theorem. The students will also learn about descriptive statistics, basic concepts, sample statistics, point estimation, confidence intervals, hypothesis testing, hypotheses for normal distribution, non-parametric methods, correlation and regression.

7 Basics of Information Systems NIRIA1SEND
Dr. László Kutor associate professor

Presentation is one of the most important determining factors and theoretical basic concepts of the information technology. The core material is divided into the subject and place of the IT in the science, features of data process, analogue and digital computation, Von Neumann architecture, coding basics, information representation (digits, numbers, characters, pictures, and music). The students will also have the chance to study minimum redundancy thesis, dictionary based data compression, code tables, adaptive compression, fault-tolerant systems (SED-SEC, Hamming code). During the seminars MATLAB will be presented in order to link their mathematical knowledge with the most important engineering software of the world.
The course covers fluids at rest: pressure, pressure gauges, surface tension, Archimedean principle, fluid in motion: Bernoulli’s equation and its applications, laminar flow and turbulent flow, viscosity, the working fluid, heat, work and the system. Other major materials to study include state equations, The First Law, reversible and irreversible processes, Carnot’s cycle, the heat engine and the heat pump, The Second Law and entropy.

In the framework of this subject the students are presented the basic elements of the electrical circuits, structure and characteristics of the active and passive circuit elements, semiconductors, the basic laws, relations of electrical engineering, semiconductor’s techniques: diode, transistors, DIAC, TRIAC. Rectifiers: 1 and 2 ways rectifying.


The students will get a deep insight into the history, development and social role of the law, state and law, the concept
of law, the legal system and the types of law, the concept, validity and effect of the legislation, the legal capacity and certain groups of entities. In the focal point of the subject there are topics like the place and role of the Constitution in the Hungarian legal system, the social relationships governed by the Constitution, the fundamental citizens' rights and obligations, groupings of public bodies and their main task and authority, the national and local bodies of legislation and enforcement. The subject also deals with the task and authority of the Parliament, the government and the local governments, the judicial authorities, the courts and the prosecutors.

BASICS OF PROFESSION

14 Programming I. NSTPR1SEND
Dr. Szabolcs Sergyán associate professor


15 Programming II. NSTPR2SEND
Dr. Szabolcs Sergyán associate professor


16 Programming III. NSTPR3SEND
Dr. Zoltán Vámossy associate professor


17 Modern Programming Language NSTMP1SEND
Dr. László Erdődi senior lecturer


A final exam which checks students’ comprehensive knowledge on software engineering and digital technology courses: Programming I-III, Software Engineering I-II, Digital Technology and Digital systems.

Theory: Open loop control system, closed loop systems, linear, time-invariant, continuous control systems, Block diagrams, some illustrative examples. Modelling Formulation of equation of Linear electrical, mechanical systems. Use of Laplace-transform, Transfer function, concepts of state variable modelling. Block diagram representation signal flow.
graphs and associated algebra, characteristics equation. Time Domain Analysis Typical test - input signal, Transient re-
response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order
systems. Steady state error and coefficients. Pole-zero location and stability. Frequency Domain Analysis Closed loop
frequency response, bode plots, stability and loop transfer function. Frequency response specification relative stability,
relation between time and frequency response for second order systems. Series compensations.

23 Digital Technology NIRDT0SEND
Dr. András Molnár associate professor
Theory: Introduction to digital technology, digital signals views. Logical circuit one and two variable, Boolean algebra,
ways to describe logic functions. Minimization of logic functions. Combination Logic members, decoders, multiplexers,
comparators. Sequential logic circuits, flip-flop, shift registers, counters, memories. Basics of Computer Science, the
internal layout of your computer. Fundamentals of microprocessor technology. Single microcomputers. Laboratory:
Basics of VHDL language and schematic design. Designing, creating and simulating one and two variables logical cir-
cuits width CAD software. Design of complex logical and sequential circuits.

24 Electronics NIREL0SEND
Dr. László Nádai associate professor
Nowadays, the mostly digital world also requires a basic knowledge of analogue circuits. In this course the students will
learn about the basic principles of analogue circuits design and operation. The students will examine discrete compo-
nents such as resistors, capacitors, diodes and transistors as well as integrated components such as operational amplifi-
ers. In addition, the students will become familiar with the operation of basic electronic circuits

25 Digital Systems NIRD0SEND
Dr. András Molnár associate professor
Theory: There has been a tremendous development in digital circuits over the past 3 decades, and there are a number
of approaches for implementation of digital circuits. This course intends to give a background on digital electronics. The
course will cover various circuit families, including diode-transistor logic (DTL), transistor-transistor logic (TTL), NMOS,
and CMOS logic. In addition, various other circuits used in digital world will be covered. These include regenerative
circuits, Schmitt-triggers, integrated circuits, RAMs, ROMs. The second part of this course is an introduction to VHDL
programming: VHDL – Overview, Concepts of VHDL, Modularity and Hierarchy, VHDL Language and Syntax, VHDL
Structural Elements, Data Types, Operators, Concurrent and Sequential statements, Synthesis, Example codes.

26 Fundamentals of Computer Architectures I. NIRSA1SEND
Dr. Péter Broczkó associate professor
The lectures present relevant knowledge about instruction level architectures and the microarchitecture of traditional
Neumann computers. The material presented is based on the design space approach. Case examples and major trends
will be given to illustrate the evolution. Major topics include: Computational models, programming languages and
architectures. Data based computational models, the von Neumann computational model, and data flow computa-
tional model. The concept of computer architecture and different levels of abstraction. The students will also study
main dimensions of the Instruction Set Architecture (ISA), memory space and register space. data types, operations,
operand-types, instruction formats, addressing methods, user visible status characteristics, operations, and introduc-
tion to processor architectures. In the framework of this subject students are presented centralized and decentralized
control, execution units, basics of bus-systems, alternatives of organizing bus operations, signal systems, classes of bus
systems, parallel and serial buses, speed limit of parallel buses, basic characteristics of parallel and serial buses (FSB,
PCI, PCIe, HT, QPI). The core material contains programmed I/O, memory mapped I/O, DMA, I/O channel, the inter-
rupt system, operation of DRAMs, types of DRAMs (SDRAM, DDR, DDR2, DDR3), characteristics of DIMMs (UDIMM,
RDIMM, ECC), architecture and principle of operation of a hypothetical computer.

27 Advanced Computer Architectures NIRKA1SEND
Dr. Péter Broczkó associate professor
Main objective of the presented material is to identify decisive aspects and main steps of the evolution of advanced
processor and system architectures. The subject discussed is based on the design space approach, emphasizing main
aspects and options for each step of the evolution as well as major trends identified. Many case examples illustrate the
material presented. Main competences aimed at include classes of multicore and manycore processors, sub-classes of
homogeneous multicore processors. Main aspects of the implementation of recent multicore processors, such as power
management, alternative implementations of the turbo boost technology, processor level support of the virtualization,
alternative ways to achieve cache coherency, basics of the remote management of processors. Implementation aspects
and examples of manycore processors. Main classes of heterogeneous ad-on processors. Heterogeneous master-slave
processors. Execution paradigm and micro-architecture of GPGPU-s. Main dimensions of platforms. Implications of
increasing core counts to system architecture. Main steps of the evolution of Intel’s, AMD’s, IBM’s, ARM’s processor and
system architectures, case examples.

28 Fundamentals of Computer Architectures II. NIRSA2SEND
Dr. Péter Broczkó associate professor

The lectures provide an overview about main classes of parallel architectures such as: pipeline, superscalar and VLIW
processors. The material presented is based on the design space approach. Case examples and the identification of ma-
jor trends concerning the evolution enhance the lectures. Major topics include levels of the utilized parallelism, Flynn’s
and an updated classification of architectures, data, control and resource dependencies and basic methods of their
handling, preserving sequential consistency, pipelined processors, superscalar processors of 1st, 2nd and 3rd generation
and ISA enhancements (MMX, SSE, etc.).
The students will also learn about layout alternatives of caches, 2-3 level cache-hierarchies, optimum size of caches,
trends, examples, VLIW and EPIC architectures, thread-level parallel, fine and coarse-grained, and SMT architectures,
process-level parallel architectures and motherboards. Objectives of the lab exercises are the following: to give an over-
view of major processor architectures, registers and instructions, execution mechanisms of machine-level programs,
their connection to operating systems, basics of compilers, structure of executable files (architecture of .COM and .EXE
files). Writing simple sequential programs, iterations and input/output operations, writing programs for calculations,
data conversations and simulations, displaying and programming of peripheral equipment (displaying graphical ele-
ments, handling of serial and parallel ports) belong to the requirements of the course.

29 Operating Systems NIROPOSEND
Dr. András Rövid associate professor

The main tasks of the operating systems are evolution of the components and its appearance in the popular operat-
ing systems (Windows, Unix, and Linux versions). The students can use command line tools and different operating
systems in the lab. The Linux system is the primary platform for the exercises; however, certain areas of the Windows
system solutions will be presented too. Key skills for students to acquire: operating systems architecture, main oper-
ating system features and modules (process and thread management, scheduling, memory management, i/o and file
management, communication between processes), the factors of development, and the need and opportunities to
standardize the adapter interfaces, solutions in the widely used operating systems.

30 Computer Networks NIRSHOSEND
Dr. Miklós Kozlovszky associate professor

The students are introduced to the structure and operation principals of computer networks. They learn about basic
terms, implementation principals and methods and reference models. The students acquire knowledge of TCP/IP fam-
ily, structure of internet, addressing scheme, IP protocol, and its directions of further development, and finally the
operation of basic protocols which provide the basic functionality of the modern internet. The students learn about the
basic physical transmissions medium in computer networks and its operating modes and features. They get an overview
of computer networks, operating methods, application possibilities and the expected performance.
Key competencies for students to reach: Network reference models, Internet principles, the addressing and name
handling policies, the IP protocol operating mode, the connection-free and connection-oriented characteristic of data
transfer and transport protocols. Local network techniques, Ethernet networks, switching and routing, Wide area net-
work technologies.

31 Introduction into Embedded Systems NIRBR1SEND
Dr. András Molnár associate professor

Students are introduced to modern embedded systems. ARM-based C #.Net programmable environment device. The
practice provides a link between the "classical" programming and the target hardware. The course starts from a "hel-
lo world"-type program to complex computer games and by different simulations guides the students in hardware and
software applications. Key skills for students to possess: hardware-based programming, use of peripheral devices, use
of sensory data, graphical LCD programming, touch screen use, CCD camera using solid-state storage devices. The ex-
ercise involves the preparation of the hardware components and appropriate program creation. The students will come
into contact with peripherals and software modules necessary for their operation relationship which is essential to any writing program of embedded systems.

32 Intelligent Systems NIRIROSEN
Dr. László Kutor associate professor


33 Enterprise Information Systems NSTVI1SEND
Dr. László Erdődi senior lecturer

Ground Concepts: information system, IT, IT resources and their classification, requirements against information and IP. External Information Model: customers, suppliers, the financial sector, government, typical data flows. Goods, Stock in Hand: changes, typical flows, the data model. Customers, Suppliers: fundamental concepts, activities, the data model. Service of Customers: quotation, order, business transactions, data model, and relations to other subsystems. Procurement: request for proposal, order, business transactions, data model, and relations to other subsystems. Invoicing: preparing an invoice, invoice processing, returning goods, connected tasks, data model, relations with other subsystems. Financial Issues: accounts receivable and payable, connected tasks, data model, relations to other subsystems. Service Functions of the System: event based/time based functions, risks and controls, user roles. Communicating with Partners: Paper – based, EDI, E-business. The History of IS’s: from the isolated subsystems to the integrated standard systems, HW/SW background.

34 Modelling of Business Information Systems NSTVI2SEND
Dr. László Erdődi senior lecturer

Project work gives a base to this course. The students acquire practice in teamwork, in designing business processes and related data models and subsystems. They will focus on decomposition of a system to functional subsystems, allocating subsystems to teams, designing business processes relating to the subsystems, design of the data models of the subsystems, design of relations among subsystems, design of procedures and inputs, design of output, tools to be used for design: process modelling software (e.g. ARIS or Signavio), or a CASE tool.

35 Fundamentals of Informatics Security NIRIB0SEND
Dr. Valéria Póser associate professor


36 Formal Languages and Automata NSTFN1SEND
Dr. László Csink associate professor

37 Decision Support Systems NSTDR1SEND
Dr. László Csink associate professor


38 Infocommunication Techniques NIRIK1SEND
Dr. Miklós Kozlovzscky associate professor


SUPPLEMENTARY SUBJECTS

41 Physical Education I. GTSTESTNEV
Györgyné Fehér trainer

Aim of the subject: to provide the conditions of regular sports activities for the students, to advertize the healthy way of living and to draw attention to the preventive values of physical training. Students can choose freely from the branches and courses offered by the Physical Education and Sports Institute

42 Physical Education II. GTSTESTNEV
Györgyné Fehér trainer

Aim of the subject: to provide the conditions of regular sports activities for the students, to advertize the healthy way of living and to draw attention to the preventive values of physical training. Students can choose freely from the branches and courses offered by the Physical Education and Sports Institute.

COMMON AND OPTIONAL SUBJECT OF SPECIALISATION

50 Basics of Robotics NAMRA1SENC
Dr. Attila Bencsik associate professor

Classification of robots, industrial robots characteristics. Mobile robots, industrial robots, direct and indirect manipulators, master-slave systems. The basic concepts of robotics: Kinematic motion-space, work-space, coordinate systems. Basic principles of arm mechanisms, mechanical, manipulative and robotic aspects. Key elements of enforcement mechanisms. Technical implementation of degrees of freedom, characteristics and scope of the executive elements of the shoots. Direct and indirect drives, gearboxes. Measuring systems for robots. Internal and external sensors, the control aspects of design requirements. General tasks of industrial robot control: position control and tracking control and its requirements. Opportunities for teaching robots, their characteristics.

51 Kinematics and Dynamics of Industrial Robots NAMRK1SENC
Dr. Jozsef Tar full professor

Translation and rotation group properties. Discrete, continuous, and Lie groups. Group-algebra, tangent space, generators, Lie algebra Jacobi identity, representations of Lie groups. The rotation group representations: orthogonal matrices

52 Robot mechatronics NAMRM1SENC

Dr. Attila Bencsik associate professor

The classification of mechatronics, its characteristics in industrial robots: basics of arm mechanisms, integrated elements of mechanical systems in manipulation, robotics point of view. Implementing elements and their application in the mechatronics robot drives. Engines in service robotics, construction requirements. Proportional servo drives and mechatronic systems for electrical, pneumatic and hydraulic enforcement agencies. Industrial robot grippers. Mechatronic units in the ends of the enforcement mechanism. Robots Monitoring: Internal and external sensors, construction, information technology requirements, designs under the control requirements. The robot's technical structure: According to the requirements of mechatronics, control-related hardware components. The practice themes: TINA-based computer simulation program practices.

53 Application of Robots NAMRL1SENC

Dr. Attila Bencsik associate professor

Types of industrial robots according to the application criteria. Terms of robotization. Technical requirements to the technology, welding, handling, painting, assembly areas. Requirements in connection with an industrial robot. Faculty mechanisms, mechanisms and mechanical systems integrated components, manipulative skills, requirements of robotic features. Economics of robotization introduction. Other aspects of robot selection: human and material, links to other elements of the technological system. Industrial robot grippers based on the robot application. Robots measurement systems, information requirements and control requirements of the application. Electrical, pneumatic and hydraulic-powered robots in a variety of technologies and services. The industrial robot according to the characteristics of the service and maintenance systems. Case studies in the area of application of industrial robots.

54 Intelligent Robot Systems NAMIR1SENC

Dr. Gyula Hermann associate professor

Interactive relationship with the environment. Intelligent sensor systems at a glance, what makes the robot intelligent? Potential amalgamation of different sensor systems. Robotic Vision Systems, description of basic methods: laser-eye stereo camera, ultrasonic systems, infrared systems and triangulation. Basic problems of mobile robots: path planning,
navigation (known and unknown environments), map making, obstacles (static and dynamic) avoidance. Marker-based position measurement is based, intelligent markers. Cooperation of mobile robots (description and basic problem of multi agent environment). Central and distributive management funds.

55 Robot Control NAMRI1SENC  
*Dr. Imre Rudas full professor*


56 Mobile Robots NAMMR1SENC  
*Dr. Zoltán Vámossy associate professor*


57 Fuzzy Systems in Engineering NAMFR1SENC  
*Dr. Márta Takács associate professor*


58 Basic Mathematical Methods in Engineering NAMAM1SENC  
*Dr. Ágota Cserjés associate professor*

Abstract spaces; optimum search under constraints; curve fitting for measurement data or data from tables; the Legendre transformation: variable substitution in multivariate functions: switchover to directly measurable quantities in thermodynamics: the introduction of the thermodynamic potentials. Declaration of the Hamiltonian and the canonical equations of motion in classical mechanics. Tensor fields in ordinary three-dimensional physical Euclidean space and its internal symmetries, bases of the group theory; real SVD and HOSVD and its geometric interpretation; Lyapunov function; Barbalat’s lemma; Pontryagin’s optimal controller, Hamiltonian; robust control, sliding control; the SVD-based adaptive control.

59 Engineering Calculation Methods NAMMS1SENC  
*Dr. Ágota Cserjés associate professor*