

Subject name: Mathematical Analysis I	Neptun code:
Responsible Lecturer: Dr. Szilvia Árvai-Homolya, associate professor	
Co-Lecturer(s):	
Suggested semester: 1	Preliminary requirements:
Classes per week: Theoretical: 3 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems <p>Attitude:</p> <ul style="list-style-type: none"> - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
Subject description:	
<p>Sets, operations on sets. Relations, functions. Real numbers and their properties. Topology of real numbers. Sequences of real numbers and their properties. Convergent sequences, Series of real numbers. Convergence criteria for series.</p> <p>Concepts of single variable function, limits, continuity. Elementary functions.</p> <p>Differentiation: derivative of elementary functions, differentiation rules, Applications: L'Hospital rule, extreme value calculation, function analysis.</p> <p>Curves given in parametric and polar coordinates.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings:	
<ol style="list-style-type: none"> 1. G. B. Thomas, M. D. Weir, J. Hass, F. R. Giordano: Thomas' Calculus 1-2-3., Addison-Wesley, 2009. 2. James Stuart: Calculus: Concepts and Contexts, Cengage Learning, 2009, ISBN 0495559725 3. I. A. Maron: Problems in Calculus of One Variable, Arihant Publishers, 2018 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Mathematical Analysis II	Neptun code:
Responsible Lecturer: Dr. Szilvia Árvai-Homolya, associate professor	
Co-Lecturer(s):	
Suggested semester: 2	Preliminary requirements: Mathematical Analysis I
Classes per week: Theoretical: 3 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems <p>Attitude:</p> <ul style="list-style-type: none"> - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
Subject description:	
<p>Indefinite integrals, basic integrals, techniques of integration. Riemann condition of integrability. The Newton-Leibniz theorem, improper integrals, applications of the definite integral.</p> <p>Real multivariable functions. Partial derivatives of multivariable functions, directional and partial derivatives. Extreme value of multivariable functions. The concept, properties and calculation of the double integral. Change of variables in double integrals, Applications of the double integral: volume, area, surface calculation. Interpretation, properties and calculation of the triple integral. Introduction of new variables (cylindrical and spherical coordinate system). Applications of the triple integral.</p> <p>Differential equations. Ordinary differential equations of the first order. Higher order differential equations.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings:	
<ol style="list-style-type: none"> 1. G. B. Thomas, M. D. Weir, J. Hass, F. R. Giordano: Thomas' Calculus 1-2-3., Addison-Wesley, 2009. 2. James Stuart: Calculus: Concepts and Contexts, Cengage Learning, 2009, ISBN 0495559725 3. Gilbert Strang: Calculus, Second Edition Wellesley-Cambridge Press 1991. ISBN 978-09802327-4-5 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Linear Algebra and Discrete Mathematics	Neptun code:
Responsible Lecturer: Dr. Sándor Radeleczi, Professor, Csc.	
Co-Lecturer(s):	
Suggested semester: 1	Preliminary requirements:
Classes per week: Theoretical: 3 Practical: 2	Requirement type: exam
Credits: 6	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education. - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. - Ability to communicate in English about professional issues using IT terminology. <p>Attitude:</p> <ul style="list-style-type: none"> - Aims to accomplish work efficiently and with high quality - Openness to get to know and learn new methods, programming languages and procedures <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
Subject description:	
<p>Sets of numbers, the Cartesian product of sets, binary relations and their graphs, the inverse of a binary relation, the notion of a function, composition of the functions, bijective and inverse functions, permutations, operations with permutations. The notion of a semigroup and group. Operations with polynomials, the notion of a ring and of a field. The division of polynomials and of the integers, Euclidean algorithm. Operation with matrices, their ring. Determinants, Cramer's rule. The notion of a complex number, operations with complex numbers in trigonometric form, Moivre's formula. Vectors in the plane and space, operations with vectors, geometrical interpretation of the vectorial and of the mixed product of space vectors, n-dimensional vectors. The notion of a linear space, subspaces, linearly independent systems of vectors, generator system and base in a linear space. The dimension of a vector space, the rank of a matrix, linear transformations and their matrices, the composition and the inverse of linear transformations, systems of linear equation, their solutions, Gauss method, Rank theorem. Eigen values and eigenvectors.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings:	
<ol style="list-style-type: none"> 1. J.K. Truss, Discrete Mathematics for Computer Scientist, Addison-Wesley; 2nd edition (1998) ISBN: 978-0201360615 2. S. Foldes, Notes on algebra, Lecture notes, Tampere University of Technology, available at: https://www.uni-miskolc.hu/~matradi/teaching_duties, Jegyzet (Lecture notes) S. Foldes - Optional 3. J. Aspnes, Notes on Discrete Mathematics - Computer Science, 2004, https://www.cs.yale.edu/homes/aspnes/classes. pdf 	
Suggested readings:	

- 1.
- 2.
- 3.
- 4.
- 5.

Subject name: Discrete Mathematics	Neptun code:
Responsible Lecturer: Dr. Sándor Radeleczi, Professor, Csc.	
Co-Lecturer(s): Dávid Gégény, assistant lecturer	
Suggested semester: 2	Preliminary requirements: Linear Algebra and Discrete Mathematics
Classes per week: Theoretical: 2 Practical: 2	Requirement type: practical mark
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education., - Having knowledge about the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Ability to communicate in English about professional issues using IT terminology. <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know and learn new methods, programming languages and procedures - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. 	
Subject description:	
<p>Theory of relations, fundamentals of graph theory. Connected components of a graph, trees, forests. Planar graphs, Euler's polyhedron formula and its corollaries: Kuratowski's theorem, characterization of bipartite graphs, independent edge sets (matchings), König's theorem, Hall's theorem, Ore's theorem. Existence of Eulerian path and Eulerian circuit, Hamiltonian path and Hamiltonian circuit. Graph coloring, chromatic number, four-color theorem. Adjacency and incidence matrices. Relations defined over sets, equivalence relations. Partial orders, partially ordered sets, chains and antichains. Linear extension of partially ordered sets. Lattices, the equivalence of the two definitions of lattices. Complemented, modular and distributive lattices and their characterization. Boolean algebra, Boolean functions and their normal forms.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings:	
<ol style="list-style-type: none"> 1. J. K. Truss, Discrete Mathematics, Addison :Weesley, 1991 2. Stephan Foldes: Fundamental Structures of Discrete Mathematics, Wiley and Sons Inc, New York, 1994 	
Suggested readings:	
<ol style="list-style-type: none"> 1. George Grätzer: Lattice theory: First concepts and distributive lattices, Courier Corporation, 2009 2. George Grätzer: General Lattice Theory (second edition), Birkhäuser Basel, 2003. 	

Subject name: Data Structures and Algorithms	Neptun code:
Responsible Lecturer: Dr. Attila Házy, Associate professor	
Co-Lecturer(s):	
Suggested semester: 2	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education. - Having knowledge about the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology - Having knowledge about the most commonly used software development methodologies, and the notation of IT system plans and documentations. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems. - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. <p>Attitude:</p> <ul style="list-style-type: none"> - Aims to accomplish work efficiently and with high quality. - Openness to get to know and learn new methods, programming languages and procedures. <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
Subject description:	
<p>The representation of real numbers.</p> <p>Algorithms of number theory (greatest common divisor, Euclidean algorithm, Fermat-test), RSA.</p> <p>Algorithms: Definition, Properties, Performance Analysis-Space Complexity, Time Complexity, Asymptotic Notations (Order of growth, the master theorem (method))</p> <p>Data structures: Introduction, Data Structures types, arrays, linked lists (singly linked lists, circular linked lists, doubly linked lists,..) stack and queue.</p> <p>Sorting (Introduction, Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Heap Sort) and searching: (Introduction, Linear search, Binary search, Fibonacci search).</p> <p>Trees (Introduction, definition and basic terminologies, representation of trees), binary Trees (basic terminologies and types, binary search trees....) and graphs.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings:	
<ol style="list-style-type: none"> 1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein-Introduction to algorithms-McGraw-Hill Science_Engineering_Math (2001) 2. G.A.V PAI, Data Structures and Algorithms, Concepts, Techniques and Applications, Volume 1, 1stEdition, Tata McGraw-Hill, 2008. 3. Richard F. Gilberg Behrouz A. Forouzan, Data Structures, Pseudo code Approach with C, 2nd Edition, Cengage Learning India Edition, 2007. 	

Suggested readings:

- 1.
- 2.
- 3.
- 4.
- 5.

Subject name: Intorduction into Physics	Neptun code:
Responsible Lecturer: Dr. Gábor Pszota, associate professor	
Co-Lecturer(s):	
Suggested semester: 2	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Physics and other natural sciences required for accomplishing profession within information technology, - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Aims to have an overview of the whole system, beyond the scope of work - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. <p>Autonomy and responsibility:</p> <p>Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them</p>	
Subject description:	
<p>Basic concepts of kinematics. Newton's laws, Momentum and its conservation, Work, energy, power. Conservative fields and potential energy. Torque. Equilibrium of rigid bodies. Free and forced linear oscillations. Hydrostatics. First law of thermodynamics. Thermodynamics of gases, solids, and liquids. Heat propagation. Electric charge, field, potential. Conductors in electrostatic field. The flow of electric charges. The concept of current, current density, voltage. Voltage sources, electromotive force. DC circuits. Joule's law. The concept of magnetic induction. Forces in a magnetic field. Dia-, para-, and ferromagnetism. Ampere's law. Electromagnetic induction. Neumann's law. Faraday's law of induction. AC circuits. Ampere-Maxwell law. EM waves.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings:	
<ul style="list-style-type: none"> - R.A. Serway and Chris Vuille: Essentials of College Physics, 2007, ISBN: 0-495-10619-4 - P.A. Tipler and Gene Mosca: Physics for Scientists and Engineers, 2004, ISBN: 0-7167-0809-4, 0-7167-0810-8 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 	

5.

Subject name: Modern Physics	Neptun code:
Responsible Lecturer: Dr. Gábor Pszota, associate professor	
Co-Lecturer(s):	
Suggested semester: 4	Preliminary requirements: Introduction into Physics
Classes per week: Theoretical: 2 Practical: 0	Requirement type:
Credits: 2	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Aims to have an overview of the whole system, beyond the scope of work, - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. <p>Autonomy and responsibility:</p>	
Subject description: Some basic concepts of special relativity. Conservative fields. Experimental foundations of quantum mechanics (black body radiation, photoelectric effect, relativistic effects). Matter waves, uncertainty relations. Fundamentals of quantum physics. The structure of atoms, systems with one or more electrons, chemical bonds, energy levels, band structure. Atomic physics fundamentals of lasers. Radioactivity, basics of nuclear physics. Reactors. Particle accelerators, interaction between radiation and matter.	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings: 1. Halliday and Resnick: Fundamentals of Physics, John Wiley & Sons, 1981., ISBN: 9780471080053 2. Alonso and Finn: Fundamental University Physics I, II, Addison-Wesley Pub., 1980. ISBN: 9780201000764, 9780201001624	
Suggested readings: 1. 2. 3. 4. 5.	

Subject name: Probability Theory and Statistics	Neptun code:
Responsible Lecturer: Dr. Sándor Fegyverneki, associate professor	
Co-Lecturer(s):	
Suggested semester: 3	Preliminary requirements: Mathematical Analysis II
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education., -Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Aims to have an overview of the whole system, beyond the scope of work <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. 	
Subject description: Concept of probability. Conditional probability. Independence of events. Random variables, distribution, cumulative distribution function, density function. Moivre-Laplace theorem. Law of large numbers. Conditional distribution and density function. Independent random variables. Distribution of minima and maxima. Central limit theorems. Sample space. Sample, sampling methods. Monte Carlo methods. Point estimations, unbiased estimations, efficiency, consistency, sufficiency. Rao-Cramer inequality. Rao-Blackwell.Kolmogorov-theorem. Interval estimations. Hypothesis testing, uniformly best tests. Parametric and non-parametric tests. Testing homogeneity and independence. Correlation and regression analysis.	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Fegyverneki Sándor (2011):Probability Theory and Mathematical statistics, electronic note, TÁMOP 4.1.2-08/1/A-2009-0033 project (in english) 2. V.K. Rohatgi, A.K. Saleh: An introduction to probability theory and statistics, Wiley, New York, 2001. 3. R. Bhattacharya, E.C. Waymire: A Basic Course in Probability Theory, Springer, New York, 2007. 4. A.O. Allen: Probability , Statistics and Queueing Theory, Academic Press, Boston, 1990. 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Introduction to CAD Systems	Neptun code:
Responsible Lecturer: Sándor Lajos, master instructor	
Co-Lecturer(s):	
Suggested semester: 4	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems, - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know and learn new methods, programming languages and procedures <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems 	
Subject description: Learning the geometric and graphic background of CAD systems, as well as the basic solid and surface modeling methods. Learning basic solid model creation methods using a specific parametric design system (Creo Parametric). Creating assemblies, mechanisms and animations, creating photorealistic images, 3D printing. Import and export models.	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings: 1. Lajos, Sándor: 3D models, electronic exercise book 2. Lee, Kunwoo: Principles of CAD/CAM/CAE Systems, Addison-Wesley 1999.	
Suggested readings: 1. Lajos, Sándor: 2D-s sketches, electronic exercise book 2. Creo Parametric Primer	

Subject name: Fundamentals of Programming	Neptun code:
Responsible Lecturer: Dr. Erika Varga Dr. Baksáné, associate professor	
Co-Lecturer(s):	
Suggested semester: 1	Preliminary requirements:
Classes per week: Theoretical: 3 Practical: 2	Requirement type: exam
Credits: 6	Program: Full time
<p>Objective and purpose of the subject: This comprehensive course gives an in depth understanding of the most important fundamental concepts in computer science and programming. In this course, you will learn basic algorithms and how to apply them in practice, then progress to writing code in C.</p> <p>Knowledge: - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the terminology and specific expressions used by software engineers in English.</p> <p>Skills: - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. - Ability to communicate in English about professional issues using IT terminology. - Ability for self-education to keep up with the evolution of information technology</p> <p>Attitude: - Openness to get to know and learn new methods, programming languages and procedures - Aims to accomplish work efficiently and with high quality</p> <p>Autonomy and responsibility: - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems.</p>	
<p>Subject description: We will discuss the following topics: basics of computer programming, programming paradigms and programming languages, the operation of compilers and interpreters, steps of program development, how to develop an algorithm and how to implement it in C, basic concepts of structured programming and control structures. You will also learn about memory management, the scope and lifetime of variables and recursive problems. In practical classes you will learn the syntax and semantics of C programming constructs. You will work with primitive data types, pointers, arrays and structs. You will have exercises for reading from and writing to standard input/output and files, as well as for defining and calling functions.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ul style="list-style-type: none"> • Brian W. Kernighan, Dennis M. Ritchie: The C Programming Language (Second Edition), Microsoft Press 2015, ISBN: 0131103628 • The GNU C Reference Manual, https://www.gnu.org/software/gnu-c-manual/gnu-c-manual.html • Microsoft C Language Documentation, https://learn.microsoft.com/en-us/cpp/c-language/c-language-reference 	
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 	

5.

Subject name: Object Oriented Programming	Neptun code:
Responsible Lecturer: Dr. Erika Varga Dr. Baksáné, associate professor	
Co-Lecturer(s):	
Suggested semester: 2	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: This course builds on the knowledge and skills you have obtained in Fundamentals of Programming. This course gives an in-depth, step-by-step guide to classes, interfaces and object-oriented programming (OOP) with Java or C#.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. - Ability to communicate in English about professional issues using IT terminology. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know and learn new methods, programming languages and procedures - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. 	
<p>Subject description:</p> <p>In the lectures we will discuss the four basic principles of object oriented programming: encapsulation, information hiding, inheritance and polymorphism; and you will learn the syntax and semantics of Java and C# constructs. In practical classes you will use either Java or C# to work with classes, constructors, and methods. You will use encapsulation to improve the robustness of the code and reduce the impact of change. You will re-use code using inheritance and composition, so as to understand the problems with inheritance and how composition solves these problems. You will also develop loosely-coupled, testable and extensible applications using interfaces. The course also covers advanced concepts like exception handling, string handling, file handling and basic utility classes</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <p>For C#:</p> <ul style="list-style-type: none"> • Microsoft C# Reference, https://learn.microsoft.com/en-us/dotnet/csharp/language-reference/ • Prof. Kinnari Mishra: Basics of C# Programming Language, Notion Press 2022, EAN: 9798886843583 <p>For Java:</p> <ul style="list-style-type: none"> • The Java Tutorials (Oracle), https://docs.oracle.com/javase/tutorial/index.html • M. T. Somashekara, D. S. Guru, K. S. Manjunatha: Object Oriented Programming with Java, PHI Learning 2017, ISBN : 9788120352872 	
Suggested readings:	

- 1.
- 2.
- 3.
- 4.
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Subject name: Computer Architectures	Neptun code:
Responsible Lecturer: Prof. Dr. Szilveszter Kovács, professor	
Co-Lecturer(s):	
Suggested semester: 1	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the terminology and specific expressions used by software engineers in English <p>Skills:</p> <ul style="list-style-type: none"> - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them - Having the expertise, shows safety consciousness, pays attention to potential risks and attacks, and prepares for protection against them 	
<p>Subject description:</p> <p>Basic computational models. Computer architecture concept. Neumann architecture: processor, memory, I/O devices, system bus. The general microprocessor architecture. Structure of processors, instruction set architecture. Processor performance measures and enhancement. CISC and RISC concept. Internal parallelization. State-of-the-art processors. The storage, semiconductor storage, their classification, operation and performance enhancement. Trends in the development of semiconductor storage devices. Buses, their classification and performance enhancement. Bus standards. I/O devices, their classification and the role of I/O control circuits. The construction of the common devices (magnetic and optical disks, displays, keyboards, pointing devices, printers), their operating principles, and performance enhancement. Command language user interfaces. Shell programming. Graphical user interfaces.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Lecture slides for the „Computer Architectures” subject available at http://www.iit.uni-miskolc.hu/~szkovacs 2. A. S. Tanenbaum, T. Austin: Structured Computer Organization, 6th Edition, Prentice Hall, 2012 3. David A. Patterson, John L. Hennessy: Computer Organization and Design, Morgan Kaufmann Publishers, 2011. 	

4. William Stallings: Computer Organization and Architecture, Pearson, 2012.

Suggested readings:

- 1.
- 2.
- 3.
- 4.
- 5.

Subject name: Computer Networks	Neptun code:
Responsible Lecturer: Prof. Dr. Szilveszter Kovács, professor	
Co-Lecturer(s):	
Suggested semester: 3	Preliminary requirements: Computer Architectures
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills</p> <ul style="list-style-type: none"> - Applying knowledge obtained during the studies, ability to install and configure computer and communication networks, solve network problems, operate and improve networks. - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Aims to have an overview of the whole system, beyond the scope of work <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them - Having the expertise, shows safety consciousness, pays attention to potential risks and attacks, and prepares for protection against them 	
<p>Subject description:</p> <p>Layered network architectures, physical layer, media access control sub-layer, channel sharing methods, common media access control standards (IEEE 802.3, 802.11), the data link layer, frame formation procedures, basic knowledge related to error protection, the network layer functions and services, traffic control methods, congestion control, inter-network cooperation, common network architectures (IPv4, IPv6), the Internet and its services.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Lecture slides for the „Computer Networks” subject available at http://www.iit.uni-miskolc.hu/~szkovacs 2. Andrew S. Tanenbaum, David J. Wetherall: Computer Networks, Prentice Hall 2010, 978-0132126953 3. James F. Kurose, Keith W. Ross: Computer Networking: A Top-Down Approach, Pearson 2012, 978-0132856201 4. Cisco Certified Networking Associate (CCNA) Introduction to Networks (ITN) 5. Cisco Certified Networking Associate (CCNA) Switching, Routing and Wireless Essentials (SRWE) 	
Suggested readings:	

- 1.
- 2.
- 3.
- 4.
- 5.

Subject name: Operating Systems	Neptun code:
Responsible Lecturer: Dr. Attila Baksa, associate professor	
Co-Lecturer(s):	
Suggested semester: 2	Preliminary requirements: Computer Architectures
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: Familiarizing students with the tasks and basic operating mechanisms of operating systems. Get to know the basic concepts of operating systems, process management, operation of backup storage, file systems. During the course, they learn about the basic management of Unix/Linux systems and general knowledge of operating systems.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability to communicate in English about professional issues using IT terminology. <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Aims to have an overview of the whole system, beyond the scope of work - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
Subject description:	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <p>ANDREW S. TANENBAUM, HERBERT BOS: Modern Operating System, Vrije Universiteit, Amsterdam, 2015, ISBN-10: 0-13-359162-X</p> <p>ANDREW S. TANENBAUM, ANDREW S. WOODHULL: Operating Systems: Design and Implementation, Upper Saddle River, NJ: Prentice Hall, 2006.</p> <p>Abraham Silberschatz, Greg Gagne, Peter Baer Galvin : Operating System Concepts, John Wiley & Sons, 2004, ISBN 0-471-69466-5</p> <p>Nutt, Gary J.: Operating systems: A Modern Perspective, Addison-Wesley, 1997, ISBN 0-8053-1295-1</p> <p>Stallings, William: Operating systems: internals and design principles, Upper Saddle River, N.J. : Prentice Hall, 2001, ISBN: 0130329866</p> <p>Bacon, J., Harris, T.: Operating systems, concurrent and distributed software design, Addison Wesley (Pearson), Harlow, 2003., ISBN 0-321-11789-</p>	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 	

5.

Subject name: Windows Operating Systems	Neptun code:
Responsible Lecturer: György Wagner, master instructor	
Co-Lecturer(s):	
Suggested semester: 7	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: The subject introduces one of the critical points of information systems, the concepts of computer security, the components used for security purposes, and their role. It explains the principles and basics of encryption in more detail. It covers public key cryptography and its role. In the second part of the course, basic programming techniques that can be used to automate business processes using MS Excel are presented.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology, - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Applying knowledge obtained during the studies, ability to install and configure computer and communication networks, solve network problems, operate and improve networks. - Ability to develop and implement corporate information systems. - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. <p>Attitude:</p> <ul style="list-style-type: none"> - Understands and adopts the ethical norms and legal aspects of the profession - Pays attention to the security of colleagues' and customers' data. <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. 	
<p>Subject description: Data; information; information security. Protection demand; sources of danger; classification of risk classes; defense costs. Protection of information; protection against physical injury; protection against unauthorized access; intrusions. Common identification methods; property-based identification; knowledge-based identification; biometric identifiers; strict identification; multifactor identification. Security policy; Firewalls; firewall building blocks: Packet filtering; stateful packet filtering; deep inspection firewall; circuit level gateway; proxy firewall. Security structures; VPN, Content filtering firewall; Web Application firewall; IPS and IDS systems; personal firewall. Virus scanners; antivirus engines; their operating principle; encrypted viruses; heuristic, resp. negative heuristic search.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Ed Bott, Craig Stinson: Windows 10 Inside Out, Microsoft Press, 2019, ISBN 978-1-5093-0591-9) 2. Orin Thomas: Inside Out Windows Server 2016 (Microsoft Press, 2017, ISBN: 978-1-5093-0248-2) 3. Ed Bott: Windows 10 IT Pro Essentials – Top 10 Tools (Microsoft Press, 2016, ISBN: 978-1-5093-0278-9) 	

4. Ed Bott: Windows 10 IT Pro Essentials – Support Secrets (Microsoft Press, 2016, ISBN: 978-1-5093-0280-2)

Suggested readings:

1. Joan Lambert: Windows 10 Step by Step (Microsoft Press, 2017, ISBN 978-1-5093-0672-5)

5. Yochay Kiriaty, Laurence Moroney, Sasha Goldshtein, Alon Fliess: Windows 7 fejlesztőknek (Szak kiadó, 2010, ISBN:978-963-9863-14-9)

Subject name: Database Systems I.	Neptun code:
Responsible Lecturer: Prof. Dr. László Kovács, professor	
Co-Lecturer(s):	
Suggested semester: 3	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop and implement corporate information systems. - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. <p>Attitude:</p> <ul style="list-style-type: none"> - Aims to have an overview of the whole system, beyond the scope of work - Openness to get to know and learn new methods, programming languages and procedures <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. 	
Subject description: Overview of persistency methods; Foundation of database systems; DBMS and DB; Semantic modelling, ER model; Relational structure and integrity rules; Conversion of ER into relational model; overview SQL; SQL DDL commands; SQL DML commands; Relational algebra; Query expressions in SQL; Conversion relational algebra into SQL; Relational database objects; Indexes and VIEW elements; normalization of relational schema. Security layer in DBMS; Basic operations in SQLite. SQL API foundations for JDBC.	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ul style="list-style-type: none"> - Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: DATABASE SYSTEMS - The Complete Book, 2008, https://www.researchgate.net/publication/200034291_Database_Systems_The_Complete_Book - Avi Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concept, 2020, ISBN-13: 978-0073523323 - L. Kovács: Database Systems I, moodle.iit.uni-miskolc.hu 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Database Systems II	Neptun code:
Responsible Lecturer: Prof. Dr. László Kovács, professor	
Co-Lecturer(s):	
Suggested semester 4:	Preliminary requirements: Database Systems I
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop and implement corporate information systems. - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. <p>Attitude:</p> <ul style="list-style-type: none"> - Aims to have an overview of the whole system, beyond the scope of work - Openness to get to know and learn new methods, programming languages and procedures <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. 	
Subject description: Overview SQL API architectures (ODBC, JDBC, JPA) , JDBC class hierarchy; JDBC classes and methods; cursor handling in JDBC; metadata in JDBC; stored procedure in Oracle, overview of PL/SQL language; SQL operations in PL/SQL, cursor management in PL/SQL, usage of PL/SQL packages; Transaction management architecture, history types in DBMS; locking protocol; operation of the locking module; query optimization module in DBMS, algebraic execution graph, optimization steps; query execution plan.	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ul style="list-style-type: none"> - Coronel, Moris: Database Systems: Design, Implementation and Management, ISBN-13: 978-1337627900, 2018 - Murab, Anirudha, Deshmukh: Principles of Database Management System, 2019, ASIN : B07PP6V5SH - L. Kovács: Database Systems II, moodle.iit.uni-miskolc.hu 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Software Technology	Neptun code:
Responsible Lecturer: Dr. Péter Mileff, associate professor	
Co-Lecturer(s):	
Suggested semester: 3	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education. - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. <p>Skills</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Ability to develop client-server, WEB-based, mobile and multi-platform applications. - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability to communicate in English about professional issues using IT terminology. <p>Attitude</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Aims to have an overview of the whole system, beyond the scope of work - Openness to get to know and learn new methods, programming languages and procedures - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. <p>Autonomy and responsibility</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
<p>Subject description:</p> <p>Basic concepts of software engineering. Features of software as a product. The software development steps and life cycle models: waterfall model, Evolutionary software development, Component-based software development, incremental (iterative) development approach. The spiral model. Process Activities. Presentation of Software requirements. Functional, non-functional requirements, user and system requirements, the requirements planning process. Exploration and analysis. The requirements document and feasibility study. Scenarios ethnography. Requirements Validation of Software Design. Architectural design, system build models. Modular decomposition, functioned piping, controlling types, object-oriented design. Unified Modelling Language (UML). Version control systems, principles of user interface design.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	

Required readings:

- Ian Sommerville: Software Engineering, Pearson; 10th edition (March 24, 2015)
- Martina Seidl, Marion Scholz, Christian Huemer, Gerti Kappel: UML @ Classroom: An Introduction to Object-Oriented Modeling, Springer; 2015th edition

Suggested readings:

- Ian Sommerville: Engineering Software Products: An Introduction to Modern Software Engineering 1st Edition, Pearson; 2019.
- Roger Pressman, Bruce Maxim: ISE SOFTWARE ENGINEERING: A PRACTITIONERS APPROACH, McGraw-Hill Education; 9th edition (November 5, 2019)

Subject name: Software Technology Lab	Neptun code:
Responsible Lecturer: Dr. Tamás Tompa, assistant lecturer	
Co-Lecturer(s):	
Suggested semester: 4	Preliminary requirements:
Classes per week: Theoretical :2 Practical: 2	Requirement type: practical mark
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: The goal of the course is to introduces the tools and methods of professional software development in large companies and the design, the development, the operation challenges are discussed, with an emphasis on best practices. During the course, students acquire practical knowledge of the tools and methods required for developing, testing, operating, and maintaining the large enterprise applications.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education. - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Ability to develop client-server, WEB-based, mobile and multi-platform applications. - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability to communicate in English about professional issues using IT terminology. <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Aims to have an overview of the whole system, beyond the scope of work - Openness to get to know and learn new methods, programming languages and procedures - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
<p>Subject description: The most important Java-based frameworks and their applications will be presented in addition to the Java programming language. Technologies and techniques covering the entire software life cycle will be introduced that the student is confident in a Java-based software development after completing the course. The course involves the followings: continuous integration, continuous development, software testing, software design patterns, version control systems, etc.</p>	
Assignment and requirements of signature:	

Requirement end evaluation of the practical mark/ exam:

Required readings:

1. Dr. Mileff Péter online books at: <http://www.iit.uni-miskolc.hu/~mileff>
2. Erich Gamma · Richard Helm · Ralph Johnson · John Vlissides: Programtervezési minták, Kiskapu, Budapest, 2004
3. Roger S. Pressman, Bruce Maxim: Software Engineering: A Practitioner's Approach 8th Edition, McGraw-Hill Education, 2014
4. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice (SEI Series in Software Engineering), Addison-Wesley Professional; 3rd edition, 2012
5. Ian Somerville: Szoftver-rendszerek fejlesztése. Panem, Budapest, 2002.

Suggested readings:

- 1.
- 2.
- 3.
- 4.
- 5.

Subject name: Security in Computer Systems	Neptun code:
Responsible Lecturer: György Wagner, master instructor	
Co-Lecturer(s):	
Suggested semester: 4	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: The subject introduces one of the critical points of information systems, the concepts of computer security, the components used for security purposes, and their role. It explains the principles and basics of encryption in more detail. It covers public key cryptography and its role. In the second part of the course, basic programming techniques that can be used to automate business processes using MS Excel are presented</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education. - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having fundamental knowledge about data security issues. <p>Skills:</p> <ul style="list-style-type: none"> - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability to communicate in English about professional issues using IT terminology. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Pays attention to the security of colleagues' and customers' data - Understands and adopts the ethical norms and legal aspects of the profession. <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Having the expertise, shows safety consciousness, pays attention to potential risks and attacks, and prepares for protection against them 	
<p>Subject description:</p> <p>Data; information; information security. Protection demand; sources of danger; classification of risk classes; defense costs. Protection of information; protection against physical injury; protection against unauthorized access; intrusions. Common identification methods; property-based identification; knowledge-based identification; biometric identifiers; strict identification; multifactor identification. Security policy; Firewalls; firewall building blocks: Packet filtering; stateful packet filtering; deep inspection firewall; circuit level gateway; proxy firewall. Security structures; VPN, Content filtering firewall; Web Application firewall; IPS and IDS systems; personal firewall. Virus scanners; antivirus engines; their operating principle; encrypted viruses; heuristic, resp. negative heuristic search.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Jonathan Katz: Digital Signatures (Advances in Information Security): 2010, Springer, ISBN: 978-0387277110 2. John R. Vacca: Computer and Information Security Handbook. 2017, ISBN 978-0-12-803843-7 3. Bruce Schneier: Applied Cryptography. 2015, ISBN 9781119096726 	
Suggested readings:	

- 1.
- 2.
- 3.
- 4.
- 5.

Subject name: Advanced IT Technologies /SW Testing	Neptun code:
Responsible Lecturer: Dr. Olivér Hornyák, associate professor	
Co-Lecturer(s):	
Suggested semester: 6	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: The main purpose of the subject is to present the main methods and techniques of software testing.</p> <p>Knowledge: - Having knowledge about the most commonly used software development methodologies, and the notation of IT system plans and documentations</p> <p>Skill: - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods.</p> <p>Attitude: - Aims to accomplish work efficiently and with high quality</p> <p>Autonomy and responsibility: - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them</p>	
<p>Subject description: An overview will be given on software quality factors. Students will</p> <ul style="list-style-type: none"> • learn what is software testing, • understand software development model, • understand architectures of modern software development processes, • learn major concepts of the testing methodologies, • learn the levels of software testing, • be familiar with different approaches to software testing, • understand of the types of testing, • be able to create test plan, • be able to the test plan, • to create and manage test cases and defect profiles, • to build strategies to track testing processes in the bug tracking systems. <p>Test First and Test Driven Development methods will be presented. Practical lessons will cover unit testing practices in some popular programming languages.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ul style="list-style-type: none"> - Foundation Level Syllabus Version 2018 V3.1 (https://castb.org/wp-content/uploads/2020/01/ISTQB-CTFL_Syllabus_2018_V3.1.pdf) - Mauro Pezzé, Michal Young: Software Testing and Analysis, process, principles and techniques, ISBN: 978-0471455936 - Graham, Dorothy, Rex Black, and Erik Van Veenendaal: Foundations of software testing ISTQB Certification. Cengage Learning, 2021. ISBN 978-1473764798 - Roy Oshero: The Art of Unit Testing, 2019, ISBN 9781617297489 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 	

- 4.
- 5.

Subject name: Web technologies foundation	Neptun code:
Responsible Lecturer: Dr. Judit Tamás Kunné, senior lecturer	
Co-Lecturer(s):	
Suggested semester: 4	Preliminary requirements: Foundation of Programming
Classes per week: Theoretical: 1 Practical: 2	Requirement type: practical mark
Credits: 3	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education. - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the most commonly used software development methodologies, and the notation of IT system plans and documentations <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop client-server, WEB-based, mobile and multi-platform applications. - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know and learn new methods, programming languages and procedures - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems 	
Subject description: HTTP standard, HTML basics, structure, list, table, images, links, forms. CSS basics, CSS selectors, CSS bokmodel. JavaScript, JQuery, AJAX, JSON, DOM, Form validation	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Stephen Ludin, Javier Garza: Learning HTTP/2- A Practical Guide for Beginners, O'Reilly Media,2017, ISBN 978-1491962442 2. Jon Duckett: HTML & CSS: Design and Build Web Sites, John Wiley & Sons, 2011, ISBN 978-1118008188 3. David Sawyer McFarland: JavaScript and JQuery: Interactive Front-End Web Development, O'Reilly Media, 2008 , ISBN 978-1449399023 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 	

5.

Subject name: Web technologies Client side	Neptun code:
Responsible Lecturer: Dr. Anita Agárdi, assistant lecturer	
Co-Lecturer(s):	
Suggested semester: 5	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: Presentation of modern client-side tools for web pages and web development. Techniques and steps for creating modern web applications, based on which students will be able to create web applications independently.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the most commonly used software development methodologies, and the notation of IT system plans and documentations -- Having fundamental knowledge about data security issues. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop client-server, WEB-based, mobile and multi-platform applications. - Ability to develop and implement corporate information systems. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
<p>Subject description:</p> <p>The following Angular elements are presented: project structure, components (overview, component lifecycle, view encapsulation, component interaction, component styles, sharing data between child and parent directives and components), templates (overview, displaying values with interpolation, template statements) understanding binding (attribute binding, class and style binding, event binding, property binding, two-way binding) understanding pipes (using a pipe in a template, transforming data with parameters and chained pipes) understanding template variables, directives (built-in directives, attribute directives, structural directives), dependency injection in Angular.</p> <p>The following Angular Material elements are presented: autocomplete, badge, bottom sheet, button, button toggle, card, checkbox, chips, core, datepicker, dialog, divider, expansion panel, form field, grid list, icon, input, list, menu, paginator, progress bar, progress spinner, radio button, ripples, select, sidenav, slide toggle, slider, snackbar, sort header, stepper, table, tabs, toolbar, tooltip, tree.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <p>Javascript documentation: https://developer.mozilla.org/es/docs/Web/JavaScript</p>	

Angular documentation: <https://angular.io/>

Angular Material documentation: <https://material.angular.io/>

Suggested readings:

- 1.
- 2.
- 3.
- 4.
- 5.

Subject name: Java Programming	Neptun code:
Responsible Lecturer: Dr. Tamás Tompa, assistant lecturer	
Co-Lecturer(s):	
Suggested semester: 4	Preliminary requirements: Object Oriented Programming
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education. - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the most commonly used software development methodologies, and the notation of IT system plans and documentations <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop client-server, WEB-based, mobile and multi-platform applications. - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know and learn new methods, programming languages and procedures - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems: 	
Subject description: The course helps deepen object-oriented programming knowledge and application of these methodology in Java techniques. Course topics: Effective use of basic Java classes (The java.lang package classes). Using collections. I/O programming (Streams, filter streams, pipes (Pipes), file access, File class). Internationality. Network management. Other technologies.	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings: 1. Cay S. Horstmann: Core Java Volume I-Fundamentals, ISBN: 978-0134177304 2. Herbert Schildt: Java: The Complete Reference, ISBN: 978-1259589331 3. Joshua Bloch: Effective Java, ISBN-10: 0134685997	
Suggested readings: 1. 2. 3. 4. 5.	

Subject name: Introduction into Artificial Intelligence	Neptun code:
Responsible Lecturer: Dr. Judit Tamás Kunné, senior lecturer	
Co-Lecturer(s):	
Suggested semester: 5	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. <p>Skills:</p> <ul style="list-style-type: none"> - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Openness to get to know and learn new methods, programming languages and procedures - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems.: 	
<p>Subject description:</p> <p>The concept of intelligence. The concept of Artificial Intelligence (AI). Turing test. Agent-based approach. Artificial intelligence application areas. Machine learning. Rule-based knowledge representation. Knowledge representation with formal logic. Resolution. Fuzzy logic. Semantic web, frameworks. Case-based systems. Discrete and Continuous search algorithms. Evolutionary algorithms. Pattern matching. Functional Programming. Cognitive psychological foundations. The human nervous system. Artificial neural networks. Forward propagation and backward propagation networks. Convolutional neural network</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Peter Norvig, Stuart J. Russell: Artificial Intelligence: A Modern Approach, Prentice Hall, 2020, ISBN 978-0-13-461099-3 2. Kevin Gurney: An introduction to neural networks, CRC Press, 1997, ISBN 9781857285031 3. Dana Vrajitoru, William Knight: Practical Analysis of Algorithm, Springer, 2014, 9783319098876 	
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. D. Dumitrescu, Beatrice Lazzarini, Lakhmi C. Jain, A. Dumitrescu: Evolutionary Computation, CRC Press, 2000, 9780849305887 2. Peter Smith: An Introduction to Formal Logic, Logic Matters, 2020, 9798675803941 	

Subject name: Electrotechnics-Electronics	Neptun code:
Responsible Lecturer:): Dr Judit Molnár Somogyiné, associate professor	
Co-Lecturer(s):	
Suggested semester: 5	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Ability to cooperate with IT and electrical engineers in teamwork, as well as with other experts when working on the requirement analysis and solution of a given problem. <p>Attitude:</p> <ul style="list-style-type: none"> - Aims to have an overview of the whole system, beyond the scope of work. - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them: 	
<p>Subject description:</p> <p>Introducing the basic electrical and magnetic phenomena, laws and circuit calculations in the case of direct current, single and three-phase alternating current excited networks. Introducing the main characteristics of equipment used in electrical energy generation, distribution, conversion and utilization (one and three-phase transformers, one and three-phase synchronous and induction machines, DC machines). Introducing semiconductors, diode, transistor, rectifier circuits, power electronic converters.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. William H. Hayt: Engineering Circuit Analysis with CD-ROM, McGraw-Hill, 2001, ISBN: 0072283645 2. Theodore Wildi: Electrical machines, drives and power systems, Prentice Hall, 2005, ISBN: 978-0131776913 3. Leon O. Chua, Charles A. Desoer, Ernest S. Kuh: Linear and nonlinear circuits, McGraw-Hill College, 1987, ISBN: 978-0070108981 4. Tietze, U., Schenk, Electronic Circuits - Handbook for Design and Applications, 2008, ISBN: 978-3-540-78655-9 	
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. Fraser, Milne: Integrated Electrical and Electronic Engineering for Mechanical Engineers, McGraw-Hill Publ., 1994, ISBN: 978-0077079734 2. https://www.khanacademy.org/science/physics/electrical-engineering 3. Robert W. Erickson, Dragan Maksimovic: Fundamentals of Power Electronics, 2001, ISBN: 978-0-306-48048-5 	

Subject name: Mobile Phone Programming	Neptun code:
Responsible Lecturer: Dr. Judit Tamás Kunné, senior lecturer	
Co-Lecturer(s):	
Suggested semester: 5	Preliminary requirements: Object Oriented Programming, Java Programming
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having basic knowledge and engineering approach about signal processing, system and network modelling, simulation and control. - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the most commonly used software development methodologies, and the notation of IT system plans and documentations <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop client-server, WEB-based, mobile and multi-platform applications. - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know and learn new methods, programming languages and procedures - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. 	
Subject description: Android foundations, system overview, publishing process. Android components, component lifecycles. Layout, UI elements. Permissions. Communication of components. Data persistence options. Localization. Media, sensors. Adapter, RecyclerView. Send and handle HTTP requests. Notifications	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Bill Phillips, Chris Stewart, Kristin Marsicano: Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch Guides, 2017, 978-0134706054 2. Dawn Griffiths, David Griffiths: Head First Android Development 2e: A Brain-Friendly Guide, O'Reilly, 2017, 978-1491974056 3. Ryan Cohen, Tao Wang: GUI Design for Android Apps, Apress, 2014, 978-1484203835 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Graphics Programming	Neptun code:
Responsible Lecturer: Dr. Péter Mileff, associate professor	
Co-Lecturer(s):	
Suggested semester: 5	Preliminary requirements: Software Technology
Classes per week: Theoretical: 2 Practical: 2	Requirement type: Practical mark
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. <p>Skills:</p> <ul style="list-style-type: none"> - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone. - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Openness to get to know and learn new methods, programming languages and procedures - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems: 	
<p>Subject description:</p> <p>Basic knowledge of computer graphics; Framebuffer; Platform dependent rendering; Graphics card pipeline model; Resources, memory management. Drawing states; Overview of development tools and platforms; Graphics card programming in an OpenGL environment; Graphic display tools in a platform-independent environment; Texturing; General structure and design of a graphics game engine; Relationship between models and entities. 2D rendering, animation, visibility and collision detection; Font management; Image synthesis and graphics framework design patterns in 3D environment; Camera management, Collision detection and speed optimization in a 3D environment. Multi-texturing; Shading methods, light maps. Visibility algorithms, space division. Terrain mapping. Particle system with posters. Application of GLSL shading language. Realization of dynamic lights, shadows, post-processing effects with GLSL. Alternative visualization technologies: ray tracing, voxel-based visualization. Scripting in game engines</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1) Eric Haines, Naty Hoffman, Tomas Akenine-Möller: Real-Time Rendering, A K Peters/CRC Press; 4th edition (August 6, 2018) 2) Jason Gregory: Game Engine Architecture, A K Peters/CRC Press; 3rd edition (August 17, 2018) <p>Recommended:</p>	

- 3) David Wolff: OpenGL 4 Shading Language Cookbook: Build high-quality, real-time 3D graphics with OpenGL 4.6, GLSL 4.6 and C++17, Packt Publishing; 3rd edition (September 28, 2018)
- 4) Sergey Kosarevsky, Viktor Latypov: 3D Graphics Rendering Cookbook: A comprehensive guide to exploring rendering algorithms in modern OpenGL and Vulkan, Packt Publishing (August 25, 2021)
- 5) Eric Lengyel, Foundations of Game Engine Development, Volume 2: Rendering, Terathon Software LLC (July 26, 2019)

Suggested readings:

- 1.
- 2.
- 3.
- 4.
- 5.

Subject name: Design of Industrial IT Systems	Neptun code:
Responsible Lecturer: Dr. Samad Dadvandipour, associate professor	
Co-Lecturer(s):	
Suggested semester: 5	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education. - Having knowledge about the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology, - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Applying knowledge obtained during the studies, ability to install and configure computer and communication networks, solve network problems, operate and improve networks. - Ability to cooperate with IT and electrical engineers in teamwork, as well as with other experts when working on the requirement analysis and solution of a given problem. <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT - Understands and adopts the ethical norms and legal aspects of the profession - Aims to accomplish work efficiently and with high quality. <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
<p>Subject description:</p> <p>Course Description: Information has a significant role in managing industrial enterprises, and information technology (IT) supports it. For instance, the decision functions apply information technology (IT) to enable the companies to integrate the decision functions that exist in many subsystems expected to manufacture and distribute a product. They consist of purchasing, sales, production planning, process control, supply chain logistics, and quality control. As is known, an industrial organization is a web of performances, or processes, that interact with each other. The perception level of the collaboration is observed as a process of constructing and swapping information. It is to say, before production. The personnel can use the received raw material. It often must be tested and approved by quality control management. Simultaneously, the staff in the production line set processes and execute production based on the rules and orders that run the planning and execution of production. It is clear that an organization operates more cost-effectively and manages its assets when performances are openly organized between the organization subsystems. We know that if the flow of information stream is inaccessible, it is supposed that the coordination is poor enough for the decision-making processes to be developed consistently. It can result in drop-back responses on the factory floor and lost productivity for condition changes. To react to the conditions changes that are not in favor of the organizations/industries or companies, implementing computer technology in the form of integrated information systems, including databases and local and wide area networks, is vital.</p>	
Assignment and requirements of signature:	

Requirement end evaluation of the practical mark/ exam:

Required readings:

1. Billo, R. E., J. D. Porter and R. J. Puerzer (2006) An Architecture for the Design of Industrial Information Systems, in Handbook of Industrial and Systems Engineering, A. Badiru, ed. Boca Raton, FL: CRC Press.
2. Darabi, H. (2006) Finite Automata Modeling and Analysis of Workflow Management Systems, International Journal of Industrial and Systems Engineering, vol. 1, no. 3, pp. 388–411.
3. Davenport, T. H. and J. E. Short (1990) The New Industrial Engineering: Information Technology and Business Process Redesign, Sloan Management Review, vol. 31, no. 4, pp. 11–27.
4. Elmasri, R. and S. B. Navathe (2004) Fundamentals of Database Systems, 4th Edition. Reading, MA: Addison-Wesley..

Suggested readings:

Elsayed, E.A. and T.O. Boucher (1994) Analysis and Control of Production Systems, 2nd Edition. Englewood Cliffs, NJ: Prentice Hall.

Subject name: Technical communication	Neptun code:
Responsible Lecturer: Dr. Károly Nehéz, associate professor	
Co-Lecturer(s):	
Suggested semester: 1	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: The main purpose of the subject is to present and substantiate the main theories and methods and techniques of information systems.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education, - Having knowledge about the terminology and specific expressions used by software engineers in English. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Ability to cooperate with IT and electrical engineers in teamwork, as well as with other experts when working on the requirement analysis and solution of a given problem. <p>Attitude:</p> <ul style="list-style-type: none"> - Aims to have an overview of the whole system, beyond the scope of work <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems.: 	
<p>Subject description: Students will learn about basics of logic, numerical systems, basics systems theory, description of information, coding, encryption and semantics, model modelling and fundamentals of computer aided modelling.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ul style="list-style-type: none"> - A. Kossiakoff: Systems Engineering Principles and Practice, 3rd edition, 2020 ISBN-13: 978-1119516668 Technical Communication, memooc.hu, lecture notes - 2017 - Elise Moss: Getting Started with Onshape, 2021, ISBN 1630574554 	
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Data Management in Web Applications	Neptun code:
Responsible Lecturer: Prof. Dr. Kovács László, professor	
Co-Lecturer(s):	
Suggested semester: 5	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type:
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop and implement corporate information systems. - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. <p>Attitude:</p> <ul style="list-style-type: none"> - Aims to have an overview of the whole system, beyond the scope of work - Openness to get to know and learn new methods, programming languages and procedures <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. 	
Subject description: History of markup languages; overview of HTML, XML and JSON formats; well formed XML; XML schema languages; features in XML schema; complex type definitions, inheritance; XML API in Web environment: DOM; Classes and methods in DOM; data manipulation in DOM, data queries in DOM; JSON formats, operation on JSON objects; data manipulations with JSON objects; overview of XSLT language; query operations in XSLT; user defined functions in XSLT	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ul style="list-style-type: none"> - Jeff Friesen: Java XML and JSON, ISBN-13: 978-1484219157, 2016 - Sai Srinivas Sriparasa: JavaScript and JSON Essentials, ISBN: 9781783286034, 2013 - Tom Mars: JSON at Work, ISBN 978-1-449-35832-7, 2017 - L. Kovács: XML data management, moodle.iit.uni-miskolc.hu 	
Suggested readings: 1. 2. 3. 4. 5.	

Subject name: Web technologies Server components	Neptun code:
Responsible Lecturer: Dr. Anita Agárdi, assistant lecturer	
Co-Lecturer(s):	
Suggested semester: 6	Preliminary requirements: Web technologies Client side
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the most commonly used software development methodologies, and the notation of IT system plans and documentations -- Having fundamental knowledge about data security issues. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop client-server, WEB-based, mobile and multi-platform applications. - Ability to develop and implement corporate information systems. - Ability for self-education to keep up with the evolution of information technology <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
<p>Subject description:</p> <p>Presentation of modern server-side tools for web pages and web development. Techniques and steps for creating modern web applications, based on which students will be able to create web applications independently.</p> <p>The following Node.js elements are presented: environment setup, first application, REPL terminal, package manager (NPM), callbacks concept, event loop, event emitter, buffers, streams, file system, global objects, utility modules, web module, express framework, RESTful API, scaling application, packaging.</p> <p>The following MongoDB elements are presented: environment, data modeling, create database, drop database, create collection, drop collection, data types, insert document, query document, update document, delete document, projection, limiting records, sorting records, indexing, aggregation, replication, sharding, create backup.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <p>Node.js documentation: https://nodejs.org/en/</p> <p>MongoDB documentation: https://www.mongodb.com/</p> <p>Express documentation: https://expressjs.com/</p>	
Suggested readings:	

- 1.
- 2.
- 3.
- 4.
- 5.

Subject name: Digital Systems	Neptun code:
Responsible Lecturer: Dr. József Vásárhelyi, associate professor	
Co-Lecturer(s):	
Suggested semester: 3	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: In the curriculum of the engineering informatics is major fundamental course. Its most important objective is to present the design approach to engineering tasks, to develop basic practical knowledge and independent problem solving skills.</p> <p>Knowledge: - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems</p> <p>Skills: - Ability to cooperate with IT and electrical engineers in teamwork, as well as with other experts when working on the requirement analysis and solution of a given problem</p> <p>Attitude: - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts</p> <p>Autonomy and responsibility: - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems</p>	
<p>Subject description: The subject presents the operation of the basic elements of embedded systems, making digital abstraction, developing skills for simple tasks with direct hardware, or low-level software solution. Through the presentation of binary arithmetic, the design of operators, functional units, and controllers, it reaches the description of the general-purpose microcontroller architecture, the use of elementary CPUs. Understand and design simple applications with microcontroller device with the use of standard peripherals. During the exercises and laboratory sessions related to the subject, the emphasis is on learning modern computer aided design methods and gaining direct, basic design/development experience.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Sarah L. Harris, David Money Harris, Digital Desing and Computer Architecture ARM edition, Morgan Kaufmann, ISBN 978-012-800056-4, 2016, pp.560 2 2. Michael D. Ciletti, Advanced Degital Design with the Verilog HDL, Pearson Education, ISBN 0-13-089161-4, 2003, pp. 982. 3. L. H. Crocket, Ross A. Elliott, M. A. Enderwitz, R. W. Stewart, The Zynq Book,Strathclyde Academic Media, www.zynqbook.com, 2014, pp. 460 	
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Development of Distributed Web Applications	Neptun code:
Responsible Lecturer: Dr. Zoltán Krizsán, associate professor	
Co-Lecturer(s):	
Suggested semester: 5	Preliminary requirements: Object Oriented Programming
Classes per week: Theoretical: 2 Practical: 2	Requirement type: Practical mark
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education, - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the most commonly used software development methodologies, and the notation of IT system plans and documentations <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop client-server, WEB-based, mobile and multi-platform applications. - Ability to develop and implement corporate information systems. - Ability to communicate in English about professional issues using IT terminology. <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know and learn new methods, programming languages and procedures - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems. 	
<p>Subject description:</p> <p>The primary goal of the subject is Java, Spring boot based shared application development. Within the framework of the subject, we can learn about technologies and their use, such as dockerization, application containerization, as well as Elastic search (search engine), Redis (application cache) services. We can learn the basics of stream-based application development using Apache Kafka.</p> <p>In the second part, we can learn about the most important Spring Cloud tools, a service detection, central configuration, client and server side load distribution.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ul style="list-style-type: none"> - Official documentation of Spring Framework: https://spring.io/ - Spring. Spring cloud config. https://cloud.spring.io/spring-cloud-config - Spring. Spring cloud gateway site: https://docs.spring.io/spring-cloud-gateway/docs/current/reference/html/ <p>[Online; utoljára ellenőrizve 2021 10 04].</p>	
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. 2. 3. 	

- 4.
- 5.

Subject name: Operations Management	Neptun code:
Responsible Lecturer: Dr. László Berényi, associate professor	
Co-Lecturer(s):	
Suggested semester: 1	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 0	Requirement type: exam
Credits: 3	Program: Full time
<p>Objective and purpose of the subject: The purpose is to learn the processes and planning calculations of operations management. In this context, the curriculum emphasizes the interpretation of the increasingly widely used pull approach in production and management and the acquisition of the applicable toolset. The students will be able to contribute to the timely delivery of the products and services in their position by mastering production planning calculations and supporting effective resource and organizational management.</p> <p>Knowledge: - Having basic knowledge and engineering approach about signal processing, system and network modelling, simulation and control.</p> <p>Skills: - Ability to develop and implement corporate information systems. - Applying knowledge obtained during the studies, ability to specify and implement embedded systems.</p> <p>Attitude: - Considers all related legal regulations and ethical norms in situations when complex approach is needed for coming to a decision - Aims to accomplish work efficiently and with high quality</p> <p>Autonomy and responsibility: - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them:</p>	
<p>Subject description: The lessons and practical parts help to acquire the guidelines of the raw material and stock management, the tools and methods of planning, implementation of the production plan, analysis and assessment of progress, as well as the principles of management and organization.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings: - Heizer, J., Render, B., Munson, C. (2020). Operations Management: Sustainability and Supply Chain Management. London: Pearson. ISBN 9780134130422 - Slack, N. (2006). Operations and process management: Principles and practice for strategic impact. Harlow: Financial Times Prentice Hall ISBN 9781292350066</p>	
<p>Suggested readings: - Schenk, M., Wirth, S., müller, E. (2010). Factory planning manual: Situation-driven production facility planning. Berlin: Springer. ISBN 9783642036347 - Greasley, A. (2008). Operations management. Los Angeles: SAGE. ISBN 9781412918831.</p>	

Subject name: Management and Organization	Neptun code:
Responsible Lecturer: Dr. István Kunos, associate professor	
Co-Lecturer(s):	
Suggested semester: 6	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education <p>Skills:</p> <ul style="list-style-type: none"> - Applying knowledge obtained during the studies, ability to specify and implement embedded systems. - Ability to perform analytical, specification, planning, development and operation tasks in a specific IT field, applying the development, debugging, test and quality assurance methods. <p>Attitude:</p> <ul style="list-style-type: none"> - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts. - Considers all related legal regulations and ethical norms in situations when complex approach is needed for coming to a decision - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them - Having the expertise, shows safety consciousness, pays attention to potential risks and attacks, and prepares for protection against them: 	
<p>Subject description:</p> <p>Foundations of leadership and organizational theories, schools of leadership theory, various leadership styles, systematic place, role and practical significance of leadership roles. Basic organizational structures, characteristics of classic and modern organizational forms, managerial aspects of their creation and effective operation. The importance of organizational development, the tools and management of the development process</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Jeffrey A. Miles: Management and Organization Theory, John Wiley & Sons Inc, New York, 2015, ISBN10 1118008952 2. Watson Tony: Management Organization and Employment Strategy. Taylor & Francis, New York, 2015, ISBN13 (EAN): 9781138980303 3. Louis A. Allen: Management and Organization, McGraw Hill, 2019, New York, ISBN10 1258784904 	
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Resource Planning	Neptun code:
Responsible Lecturer: Dr. Gyula Kulcsár, associate professor	
Co-Lecturer(s):	
Suggested semester: 6	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
Objective and purpose of the subject:	
<p>Knowledge:</p> <ul style="list-style-type: none"> - Having basic knowledge and engineering approach about signal processing, system and network modelling, simulation and control - Having knowledge about the terminology and specific expressions used by software engineers in English <p>Skills:</p> <ul style="list-style-type: none"> - Ability to develop and implement corporate information systems - Based on knowledge obtained during the studies, ability to gain deeper knowledge, review literature and solve problems in a specific IT field alone - Ability to cooperate with IT and electrical engineers in teamwork, as well as with other experts when working on the requirement analysis and solution of a given problem <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT - Aims to have an overview of the whole system, beyond the scope of work - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems 	
Subject description:	
<p>Basic concepts: process, system, enterprise, system engineering and functional models of the enterprise. Basics of resource planning and scheduling. Application of mathematical models and soft-computing methods. Multi-objective optimization. Combining usage of search techniques and simulation, application possibilities in practice. Planning the allocation and use of resources over time. Classification of scheduling problems. Classical and extended versions of scheduling models and algorithms. Modelling and solving production scheduling problems in practice (case studies).</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
Required readings:	
<p>1. Gyula Kulcsár: Resource planning. Teaching aids and lecture outlines. http://ait.iit.uni-miskolc.hu/~kulcsar</p> <p>2. Gyula Kulcsár, Mónika Kulcsárné Forrai, Péter Bikfalvi: Scheduling models and algorithms. MEMOOC online course: http://www.memooc.hu:18010/</p> <p>3 Peter Brucker: Scheduling Algorithms, 5th ed., Springer-Verlag Berlin Heidelberg, 2007, ISBN-10 354069515X</p>	
Suggested readings:	
<p>1. Michael L. Pinedo: Planning and Scheduling in Manufacturing and Service, 2nd ed., Springer Verlag New York, 2009, ISBN: 978-1-4899-8559-0</p> <p>2. Michael L. Pinedo: Scheduling Theory, Algorithms, and Systems, 3rd ed., Springer Verlag New York, 2008, ISBN: 978-1-4899-9043-3</p>	

Subject name: Integrated ERP Systems	Neptun code:
Responsible Lecturer: Dr. Samad Dadvandipour, associate professor	
Co-Lecturer(s):	
Suggested semester: 3	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: Enterprise Resource Planning (ERP) is the industry tenure used to define a comprehensive set of activities supported by the multi-module application software that helps a manufacturer or other significant issues of its business. Enterprise Resource Planning (ERP) is a technique to integrate the data and processes of a business organization or company into a single system. ERP systems have many components, including hardware and software, to achieve integration.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> • - a) Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education. - Having knowledge about the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology, - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems <p>Skills:</p> <ul style="list-style-type: none"> - Ability to apply the scientific principles and methods (in the field of mathematics, physics and other natural sciences) required for accomplishing profession within information technology in the course of building information systems - Applying knowledge obtained during the studies, ability to install and configure computer and communication networks, solve network problems, operate and improve networks. - Ability to cooperate with IT and electrical engineers in teamwork, as well as with other experts when working on the requirement analysis and solution of a given problem. <p>Attitude:</p> <ul style="list-style-type: none"> - Authentic representative of professional principles in IT. - Understands and adopts the ethical norms and legal aspects of the profession - Aims to accomplish work efficiently and with high quality <p>Autonomy and responsibility:</p> <ul style="list-style-type: none"> - Reveals the failures of the applied technologies, the risks of the processes and initiates taking measures to decrease them 	
<p>Subject description: The course topics include production planning, paying for or acquiring parts /spare parts, maintaining stocks, cooperating with suppliers, making customer services available, and following orders. ERP can also include application modules for a business's finance and human resources aspects. Some of the ERP subcontracting markets are J. D.Edwards, System Application and Production (SAP), People soft, as well as IBM, Microsoft, and Oracle.</p>	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings: 1. Alexi Leon.: Enterprise Resource Planning – Publishing by McGraw Hill Publishing Company Limited, Copyright 2008, Alexi Leon. ISBN(13) 978-0-07-065680-2.</p>	

2. Khalid Sheikh: Manufacturing Resource Planning (MRP II), "Introduction to ERP, SCM, and CRM," by Publisher: McGraw-Hill. ISBN-13: 978-0071392303
ISBN-10: 0071392300
3. The Impact of Enterprise Systems on Corporate Performance: A study of ERP, SCM, and CRM System Implementations [An article from Journal of Operations Management] by K.B. Hendricks; V.R. Singhal; and J.K. Stratman, Publisher: Elsevier
4. ERP and Supply Chain Management by Christian N. Madu, Publisher: CHI- ISBN-13 : 978-0967602349
5. Implementing SAP ERP Sales & Distribution by Glynn C. Williams, Publisher McGraw-Hill: ISBN-13: 978-0071497053

Suggested readings:

1. Claus Ibsen: Camel in action, Manning Publications, ISBN-10: 1935182366, p. 552, 2011.
2. G. Hohpe, B. Woolf: Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions. Addison-Wesley Professional, ISBN: 0321200683, 2003.
3. D. S. Linthicum: Enterprise Application Integration. Addison Wesley, ISBN: 0201615835, 1999

Subject name: Advanced Java	Neptun code:
Responsible Lecturer: Dr. Zoltán Krizsán, associate professor	
Co-Lecturer(s):	
Suggested semester: 6	Preliminary requirements:
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: The purpose of the subject is to introduce writing SOLID, well-testable codes. Those who already know the basic principles of object-oriented programming can learn to use it at a higher level. The options provided by the Java SDK are reviewed through examples, such as collections, functional programming lambda expressions.</p> <p>Knowledge: - Having an English language proficiency sufficient to complete the programme, review English language literature, to comprehend and process texts of specific vocabulary and to perform professional tasks being qualified for as well as to continue professional self-education, - Having knowledge about the main programming paradigms, the top programming languages and development environments. Including modelling of information systems, development of systems using databases, building, operating and implementing computer networks, developing user interfaces and graphical applications, as well as being aware of the specifics of intelligent systems and mobile applications, managing modern operating systems and considering IT security aspects. - Having knowledge about the most commonly used software development methodologies, and the notation of IT system plans and documentations</p> <p>Skills: - Ability to develop client-server, WEB-based, mobile and multi-platform applications. - Ability to develop and implement corporate information systems. - Ability to communicate in English about professional issues using IT terminology.</p> <p>Attitude: - Openness to get to know and learn new methods, programming languages and procedures - Aims to accomplish work efficiently and with high quality</p> <p>Autonomy and responsibility: - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems</p>	
Subject description:	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <p>a) Books of Robert C. Martin : https://www.goodreads.com/author/show/45372.Robert_C_Martin b) Robert C. Martin: Clean code c) Joshua Kerievsky, Martin Fowler (Foreword by), Ralph Johnson (Foreword by) Refactoring to patterns; ISBN-13: 978-0321213358</p>	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	

Subject name: Embedded Systems	Neptun code:
Responsible Lecturer: Dr. József Vásárhelyi, associate professor	
Co-Lecturer(s):	
Suggested semester: 6	Preliminary requirements: Digital Systems
Classes per week: Theoretical: 2 Practical: 2	Requirement type: exam
Credits: 5	Program: Full time
<p>Objective and purpose of the subject: The purpose of the embedded systems course is to familiarize students with the design methods of embedded systems, the design tools used, and the use of standard communication protocols.</p> <p>Knowledge: - Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems</p> <p>Skills: - Ability to cooperate with IT and electrical engineers in teamwork, as well as with other experts when working on the requirement analysis and solution of a given problem</p> <p>Attitude: - Openness to get to know other disciplines that use IT tools in order to develop IT solutions for the discipline in cooperation with its experts</p> <p>Autonomy and responsibility: - Feels responsibility for his/her activity when working alone or in a team on analyzing, developing and operating information systems</p>	
Subject description:	
Assignment and requirements of signature:	
Requirement end evaluation of the practical mark/ exam:	
<p>Required readings:</p> <ol style="list-style-type: none"> 1. Vahid F., Givargis T.: Embedded System Design, a Unified Hardware/Software Introduction, Wiley and Sons, ISBN 0-471-38678-2, 2002, pp. 324. (k) 2. Li Q., Yao C.: Real-Time Concepts for Embedded Systems, CMP Books, ISBN: 1-57820-124-11993 (a) 3. Peter Wilson, Design Recipes for FPGAs using Verilog and VHDL, Newnes, ISBN 978-0-08-097129-2, 2007, pp. 370 4. C. "Max" Maxfield: The Design Warrior's Guide to FPGAs, Elsevier, ISBN: 0-7506-7604-3, 2004, pp. 560 5. L. H. Crocket, Ross A. Elliott, M. A. Enderwitz, R. W. Stewart, The Zynq Book, Strathclyde Academic Media, www.zynqbook.com, 2014, pp. 460 	
Suggested readings:	
<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 	