Application of mathematical softwares
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Application of mathematical softwares**	Credit value: 6
Course responsible and lecturer (name, academic title): **Dr. habil László Hanka PhD**	
Course classification: **Research topic related basic course**	
Proportion of theoretical and practical content, "Training character": 100 % - practice	
Type of class: lecture / seminar / **practice** / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** - problem orineted programming - making m-files - making live scripts - making Simulink model and simulation	
Form of assessment (exam / practical grade / other): **practical grade** Additional (specific) methods of knowledge assessment: - Presenting mathematcal models, using Excel, Matlab codes, Simulink simulation	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): **no**	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- programming Excel - programming Matlag - making m-files, making codes with live editor - making Simulink model - communication between Matlab and Simulink - communication between Matlab and Excel - using matlab Toolboxes	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- www.mathworks.com: users manuals: - Matlab programming fundamentals, user's guide	

- Symbolic math toolbox, user's guide - Simulink, user's guide
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- www.mathworks.com: users manuals: - Staistics toolbox, user's guide - Optimization toolbox, user's guide - Data analysis, user's guide - Fuzzy logic toolbox, user's guide

Date: 01.09.2025.

Prepared by:

Dr. habil László Hanka

Automatic Flight Control Systems of the UAV/UASs
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Automatic Flight Control Systems of the UAV/UASs**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Dr. habil. Róbert Szabolcsi, DSc.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject.	
Proportion of theoretical and practical content, "Training character": 60% - 40% theory – practice.	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes. **Methods and (specific) approaches, characteristics used to deliver the course content:** after theoretical lectures students start to work over solution of their individual project work. Students shall summarize their results in scientific essay being evaluated and graded after.	
Form of assessment (exam / practical grade / other): 'Exam' Additional (specific) methods of knowledge assessment: the project work and its results shall be presented in the classroom, and MATLAB script prepared to support engineering and scientific solutions are checked and results are evaluated, validated and graded.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4.	
Prerequisites (if any): —	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- Mathematical models of the spatial motion of the UAVs. - Classical (SISO) and modern (MIMO) models of the UAV spatial motion. - Open and closed loop automatic flight control systems of the UAVs. - Computer-aided design of the UAV autopilots and flight control systems. Controler synthesis using classical approach (pole placement). - Controller synthesis using optimal LQR method.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- R. K. Yedavalli: Flight Dynamics and Control of Aero and Space Vehicles. John Wiley & Sons, Ltd., ISBN: 978-1-118-93445-6, 2020. - R. Szabolcsi: Conceptual and Preliminary Computer-Aided Design and Analysis of the Small UAVs Applied in Governmental Purposes, ISBN 9786150230498, 254p, Budapest, 2025. - MATLAB 2025b, User's Guide, The MathWorks Ltd., 2025.	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

- Jameel Al-Kamil Safa; Szabolcsi Róbert: Optimizing path planning in mobile robot systems using motion capture technology. Results in Engineering, (2590-1230, 2590-1230): Vol 22 Paper 102043. 9 p., 2024.
- Al-Kamil Safa Jameel; Szabolcsi Róbert: Enhancing Mobile Robot Navigation: Optimization of Trajectories through Machine Learning Techniques for Improved Path Planning Efficiency. Mathematics (2227-7390): 12 12, pp(1787-1807), 2024.
- Ahmed Douzi; Róbert Szabolcsi; Judit Lukács: Cybersecurity and the flight safety of unmanned aerial systems and unmanned aerial vehicles Interdisciplinary Description of Complex Systems (1334-4684 1334-4676): 23 2 pp(95-104), 2025.

Date: August 28 2025, Budapest, Hungary.

Prepared by:

Prof. Dr. habil. Róbert Szabolcsi, DSc

Control System Design using MATLAB
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Control System Design using MATLAB**.	Credit value: 6.
Course responsible and lecturer (name, academic title): Prof. Dr. Róbert Szabolcsi, DSc.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject.	
Proportion of theoretical and practical content, "Training character": 40% - 60% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes. **Methods and (specific) approaches, characteristics used to deliver the course content:** The course starts with proper and solid theoretical introduction to scientific fields being explored. Students continue with solution of control problems traced to the hot topics of the modern era.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: at the end of the course students delived presentation with their results. MATLAB scripts they prepared are tested and validated in running mode.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4.	
Prerequisites (if any): —	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- . - . - .	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Szabolcsi, R.: Control System Design using MATLAB®, ISBN 9789634491873. Budapest, Óbuda University, 396 p., 2020. - Ali Mahmood; Róbert Szabolcsi: A Systematic Review on Risk Management and Enhancing Reliability in Autonomous Vehicles. Machines, ISSN 2075-1702, 13 646, pp(1-19), 2025. - Al-bayati Karrar Y. A.; Mahmood Ali; Szabolcsi Róbert: Robust Path Tracking Control with Lateral Dynamics Optimization: A Focus on Sideslip Reduction and Yaw Rate Stability Using Linear Quadratic Regulator and Genetic Algorithms. Vehicles, ISSN 2624-8921, 7 2, 16 p., 2025. - MATLAB 2025b, User's Guide, The MathWorks Ltd., 2025.	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

- Jameel Al-Kamil Safa; Szabolcsi Róbert: Optimizing path planning in mobile robot systems using motion capture technology. Results in Engineering, (2590-1230 2590-1230): Vol 22 Paper 102043. 9 p., 2024.
- Al-Kamil Safa Jameel; Szabolcsi Róbert: Enhancing Mobile Robot Navigation: Optimization of Trajectories through Machine Learning Techniques for Improved Path Planning Efficiency. Mathematics (2227-7390): 12 12, pp(1787-1807), 2024.
- Ahmed Douzi; Róbert Szabolcsi; Judit Lukács: Cybersecurity and the flight safety of unmanned aerial systems and unmanned aerial vehicles Interdisciplinary Description of Complex Systems (1334-4684 1334-4676): 23 2 pp(95-104), 2025.

Date: August 28 2025, Budapest, Hungary.

Prepared by:

Prof. Dr. habil. Róbert Szabolcsi, DSc

Critical infrastructures
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Critical infrastructures**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Dr. Zoltan RAJNAI	
Course classification: Basic course (subjects) in the field of safety and security science/ **Research topic related basic course** / Optional subject	
Proportion of theoretical and practical content, "Training character": 50 % - 50 % theory - practice	
Type of class: **lecture** / seminar / **practice** / consultation and total number of classes in the given semester: 30 classes Methods and (specific) approaches, characteristics used to deliver the course content: The main goal of the course is to arouse the students' interest and deepen their knowledge during the interactive lecture, thereby providing an opportunity to successfully conduct research and successfully fulfill publication requirements. During the learning process, doctoral students produce research materials in individual and group work as project assignments.	
Form of assessment (**exam** / practical grade / other): During the semester, following theoretical lectures, in the framework of small group processing, research is conducted in the identification and classification of critical infrastructures, also strengthening the project approach. The research results are prepared with encouragement for joint publication, which can be connected to the research planned in the individual research plan, and there is a further opportunity to include them in the doctoral dissertation, focusing on the relationship between hypotheses and new results.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): -	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- Introduction to critical infrastructures - Classification and classification system - Introduction to the legal framework - Understanding and regulation of EU critical infrastructure - Preparation and delivery of presentations within the framework of a project assignment, connection with one's own research areaPreparation and holding presentations of conferences on one's own field of research	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
– *Critical Foundations Protecting America's Infrastructures. The Report of the President's Commission on Criticai Infrastructure Protection, Washington* – *Green Paper on a European Programme for Critical Infrastructure Protection, Brussels, 17.11.2005 COM(2005) 576 final*	

– G8 Principles for Protecting Critical Information Infrastructures (Adopted by the G8 Justice&Interior Ministers, May 2023
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- Identity and Change in the Network Society. Conversation with Manuel Castells. http://globetrotter.berkeley.edu/people/Castells/castells-con4.html - Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism (USA PATRIOT ACT) Act of 2021 - The National Strategy for the Physical Protection of Critical Infrastructures and Key Assets. http://www.dhs.gov/interweb/assetlibrary/Physical_Strategy.pdf

Date: 11 September 2025

Prepared by:

PROF. DR. ZOLTAN RAJNAI

Cybersecurity
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Cybersecurity**	Credit value: 6
Course responsible and lecturer (name, academic title): Lajos Muha, PhD	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 75% - 25% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** The lectures are supplemented with case studies.	
Form of assessment (exam / practical grade / other): Exam	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): none	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
To familiarize students with the place and role of cybersecurity and possible solutions for protection. - Elements of cybersecurity in Hungary and the European Union. - Cybersecurity requirements (NIS2 and the Cybersecurity Act, ISO27001). - The process of organizing and planning security, - Issues related to practical implementation.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Muha Lajos - Krasznay Csaba: Az elektronikus információs rendszerek biztonságának menedzselése; NKE, 2022, http://hdl.handle.net/20.500.12944/18030, 133, ISBN 978-963-498-492-4 - Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union ... (NIS 2 Directive) - Krasznay Csaba: Kiberbiztonság a XXI. században – Budapest, Katonai Nemzetbiztonsági Szolgálat, 2022., ISBN: 978-615-6128-11-9	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Kovács László: A kibertér védelme, Dialógus Campus Kiadó, Budapest, 2018 - Kovács László: Kiberbiztonság és -stratégia, Ludovika Egyetemi Kiadó, 2018 - Global Cybersecurity Index (GCI) 2024, ITU Publications, https://www.itu.int/en/ITU-	

Cybersecurity
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

D/Cybersecurity/Documents/GCIv5/2401416_1b_Global-Cybersecurity-Index-E.pdf

Date: Budapest, 01. 09. 2025.

Prepared by:

Lajos Muha, PhD

Damage analysis of the structural materials
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Damage analysis of the structural materials**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Dr. habil. Kovács Tünde Anna, PhD., habil., professor	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 70 % - 30 % theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** Lecture, through case studies. Overview of material tests suitable for investigating the causes of damage events. Analysis of practical cases, analysis of the effects of material structure properties and condition indicators.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: Written study paper and oral presentation thereof	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): *none*	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- During the course, students will review the types of damage, their manifestations, detection methods, and the material structural causes of damage. - Students will learn about ways to prevent damage and surface treatment and heat treatment technologies for structural materials to prevent damage. - The causes of the onset of the damage process and methods for determining and modeling the kinetic function of damage will be analyzed.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Ginsztler J., Dévényi L.: Alkalmazott anyagtudomány, Műegyetemi Kiadó, Budapest 2005 ISBN 0-395-43305-3. - Mechanical Testing and Evaluation Volume 8 of the ASM Handbook 2000. - Giulio Lucio Sergio Sacco, Carlo Battini, Chiara Calderini: A case study of preliminary damage detection of two heritage vaults through geometric deformation analysis on 3D point clouds, Structures, Volume 68, 2024, 107175, ISSN 2352-0124, https://doi.org/10.1016/j.istruc.2024.107175..	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

- Corrosion: Fundamentals, Testing, and Protection Volume 13A of the ASM Handbook. 2003. ASM Handbook Committee.
- B. Bhushan: Introduction to Tribology, 2nd Edition March 2013, A John Wiley & Sons, Ltd., Publication
- G.E. Totten: Surface modification Totten heat treating, Marcel Dekker, 2004

Date: Budapest, 2025.008.15.

Prepared by:

Prof. Dr. Kovács Tünde Anna

Defence characteristics of large industrial investments
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Defence characteristics of large industrial investments**	Credit value: 6
Course responsible and lecturer (name, academic title): Dr. Tamás Berek (PhD)	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 80 % theory - 20% practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** In addition to the traditional lectures, presentations and multimedia presentations, the organization of seminars, during which complex topics requiring opinion-forming are processed in order to develop critical thinking by processing knowledge in depth.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: Evaluation of the preparation of a study/conference paper/publication identified during consultations aimed at solving a real-life problem relevant to the topic area.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- The aim of the course is to familiarize students with the requirements for the implementation of comprehensive and permanently continuous protection in the implementation of construction investments and in the construction of security technology subsystems through the implementation of complexity that increases efficiency. - Physical security tools. Protection of the construction site as an object. Assessment of the threat. Functions of a component of the protection complex and its impact on the effectiveness of the security system. They are the components of the complex system. Conditions of application of systems of mechanical and electronic protection devices in the case of large industrial investments. - The requirements of trouble-free operation and the tasks of ensuring it. The role and tasks of the manpower component of the complex protection system in maintaining the protection functions. The proportion and task of manpower protection in the different stages of completion of construction.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

1. Lajos Berek, Tamás Berek, László Berek: Personal and Property Security, Óbuda University, Budapest, 2016.
2. Lajos Berek: The Basics of Guarding and Protection as a Defining Area of Security Technology, Budapest, ZMNE.
3. Li, F., Du, W. W., Li, R. Q., & Wang, Z. S. (2018). Seven Sections Research Method Based on Engineering. J. Phys. Conf. Ser., 1087(4). https://doi.org/10.1088/1742-6596/1087/4/042027

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

1. Attila Tóth-Levente Tóth: Security Technology, NUPS, Budapest, 2014. ISBN 978- 615-5305-56-6
2. Christián L,-Major L,- Szabó Cs [ed.]: Security Leader Handbook, Ludovika University Publishing House, Budapest, 2020. ISBN 978-963-5310-70-8.
3. Horváth T. : Mechanical protection as a delay in physical protection, NUPS
4. Budapest, 2021 In. Hadmérnök p 23–32. ISSN 1788-1919 (online).

Date14-09-2025.

Prepared by:

Dr. Tamás Berek

Strong Nonlinear Oscillator
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Strong Nonlinear Oscillator**	Credit value: 6
Course responsible and lecturer (name, academic title): Livia Cvetityanin, Prof.Em.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": …50…% - …50...% theory – practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** case presentations and case study analyses, project work,	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment:	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): **none**	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
Objective of the course: To provide students with fundamental knowledge of strong nonlinear oscillator and its applications in engineering systems. **Description of knowledge to be acquired:** Students will acquire - understanding of strong nonlinear vibrations, - analytic solving procedures, - nonlinear damped vibrations, - forced vibrations and chaotic motion in strong oscillators, - one- and two degrees of freedom strong nonlinear systems, and - examples of application in science and engineering.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

Strong Nonlinear Oscillator
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

- **L. Cveticanin — *Strong Nonlinear Oscillators: Analytical Solutions*, Springer, 2018** - L. Cveticanin — *Generalized Krylov-Bogoliubov method for solving strong nonlinear vibration*, Chapter 9 Part F1825 in Lectures in Nonlinear Dynamics (eds. J.R.C. Piqueira, C.E.N. Mazzilli, C.P. Pesce, G.R. Franzini), Springer Natura, Switzerland, 2024, 253-283.
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- L. Cveticanin, M. Zukovic, D. Cveticanin (2024) Approximate analytic frequency of strong nonlinear oscillator. Mathematics 12 (19), 3040, pages 16. - L. Cveticanin, N. Herisanu, G.M. Ismail, M. Zukovic (2025) Vibration of the Liénard oscillator with quadratic damping and constant excitation. Mathematics 13, 937, pagess 15 - L. Cveticanin (2025) Exact solutions for strong nonlinear oscillators with linear damping. Mathematics 13, 1662, pages 25

Date: 17 September 2025

Prepared by:

Livia Cvetityanin

Different aspects of critical infrastructur protection>
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Different aspects of critical infrastructure protection**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Dr. János Besenyő	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 100% theory	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** Classroom lectures, case presentations and case studies, participation in project work (article writing).	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: The student has the opportunity to publish in the English-language, international journal operated by the African Research Institute of the Doctoral School of Security Studies (Journal of Central and Eastern European African Studies/JCEEAS)	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): -	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- I will introduce and explain the general concept, properties and importance of critical infrastructure, and then the options for its protection. - Description of the most important activities related to the protection of critical infrastructures, such as prevention, preparation and the development of resilience. - We will separately deal with the international and domestic legal regulation of the topic, as well as the various responses to challenges and risks. - I will introduce the vital infrastructure sectors and the areas that are part of critical infrastructure (e.g. hospital security, bank security, agricultural security, food security, energy security, transport security, information and communication security, etc.). - We will deal with the threats to the infrastructures of different sectors, the process of preparing protection plans, the application of protection measures, and other current issues related to critical infrastructure protection.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Tünde Anna Kovács, Igor Fürstner: Critical Infrastructure Protection: Advanced Technologies for Crisis Prevention and Response, Cham, Springer Nature, 2025, ISBN: 9789402423082, 339 pages.	

- Tünde Anna Kovács, Zoltán Nyikes, Tamás Berek, Norbert Daruka, László Tóth: Critical Infrastructure Protection in the Light of the Armed Conflicts, Cham, Springer Nature, 2024, ISBN: 9783031479908, 534 pages.
- Ryan K. Baggett, Brian K. Simpkins: Homeland Security and Critical Infrastructure Protection, 2nd Edition,Santa Barbara, California, ABC-CLIO, 2018, ISBN: 9798216098744, 432 pages.
- Kelley A. Pesch-Cronin, Nancy E. Marion: Critical Infrastructure Protection, Risk Management, and Resilience: A Policy Perspective, New York, CRC Press, 2016, ISBN: 9781315310633, 384 pages.
- Alessandro Lazari: European Critical Infrastructure Protection, Cham, Springer, 2014, ISBN: 9783319074979, 154 pages.

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- L. Kruszka, M. Klósak, P. Muzolf: Critical Infrastructure Protection: Best Practices and Innovative Methods of Protection, Amsterdam, IOS Press, 2019, ISBN: 9781614999645, 168 pages.
- Dr. Bognár Balázs, Dr. Katai-Urban Lajos: Létfontosságú rendszerek és létesítmények védelme, Kézikönyv a katasztrófavédelmi feladatok ellátására, Budapest, Nemzeti Közszolgálati Egyetem, Katasztrófavédelmi Intézet, 2015, ISBN: 9786155057496, 147 pages.
- Besenyő János, Deák Gabriella: A biztonság új aspektusai: A kórházi személyzet biztonsága – A kórházi erőszakos cselekedetek megelőzése, Székesfehérvár, Összhaderőnemi Parancsnokság Tudományos Tanács, 2010, ISBN: 9789630692199, 72 pages.

Date: 14.08.2025.

Prepared by:

Prof. Dr. János Besenyő

Disaster Management IT Systems
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Disaster Management IT Systems**	Credit value: 6
Course responsible and lecturer (name, academic title): Dr. Dora Maros PhD	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 50% - 50% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** project work, reading compulsory and recommended literature	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: 4 consultations per semester	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): none	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
Aim of the course: To familiarize the Hungarian disaster management with the IT systems and networks, with special regard to the applications that support disaster response and recovery processes, disaster damage assessment, situation assessment and decision-making. *Knowledge:* Managing GIS-based disaster management databases. IT background, network structure and supervision of public alarm and information systems. National Information System for Disaster Management (KOIR), National Nuclear Accident Response System (ONER), National Radiation Monitoring, Signalling and Control System (OSJER), Nuclear Accident Response Decision Support Systems (RODOS, SINAC), Database of Hazardous Industrial Plants, MOLARI, SEVESO Systems. Storm and flood warning systems. Satellite and air disaster management IT solutions.	

Disaster Management IT Systems
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

List of the 2-5 most important *compulsory* literature (notes, textbooks) with bibliographic data (author, title, publication data, pages, ISBN):

- Barnabás, Sándor, Dr. Nagy Rudolf: Certain Issues of IT Support for Disaster Protection, Protection, Volume 6, Issue 2
- Attila István VÉGH: Integration of Disaster Management IT Systems, Military Engineer, 13. Volume 2 – June 2018 (http://www.hadmernok.hu/182_31_vegh.pdf
- Act CXXVIII of 2011 on Disaster Management and the Amendment of Certain Related Acts

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- Viktória Bene: Monitoring systems and the use of unmanned aerial vehicles for public protection in the vicinity of hazardous plants, Bulletin of Aeronautics 34(1):23-42, November 2022
- MoLaRi System (https://www.katasztrofavedelem.hu/49/molari-rendszer?fbclid=IwY2xjawNcW5tleHRuA2FlbQIxMAABHqx_TWVkzCWyO9GWsRWbMhvchMRxK3m7HfZ49Pqnc4IUoq_VDtJW5ABjNr2T_aem_kgf-Vv5X3lkp9T5iR6-Wbg)
- Favour Olaoye, Axel Egon: Early Warning Systems for Natural Disasters, Interaction Design and Architecture(s), August 2024

Date: 11 September 2025

Prepared by:

Dr. Dora Maros

OBUDA UNIVERSITY YEAR OF JUBILEES
ÓE 15 145 630
TRADITION AND INNOVATION

Empirical Models, Mathematical Modelling
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Empirical Models, Mathematical Modelling**	Credit value: 6
Course responsible and lecturer (name, academic title): Richárd Horváth, PhD	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 100 % - 0 % theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** - The aim of the course is to introduce students to the methods of mathematical modelling. - It gives an overview of system modelling possibilities and ways to describe the connection between input and output data series.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: - completing the assigned task during the semester;	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): –	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- The course presents the basic principles and concepts of mathematical modelling. - Special attention is given to different system modelling methods (black and grey box models). - Methods suitable for creating phenomenological models are also introduced. - Students gain insight into some optimization techniques, data structure processing, and searching for data connections.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Khuri, A. I. (2006). Response surface methodology and related topics. World scientific.	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Forgács, A., Lukács, J., Csiszárik-Kocsir, Á., & Horváth, R. (2024). Towards the Investigation of Online Shopping Behaviours Using a Fuzzy Inference System.	

Decision Making: Applications in Management and Engineering, 7(2), 337-354. https://doi.org/10.31181/dmame7220241059

- Réger, M., Horváth, R., Széll, A., Réti, T., Gonda, V., & Felde, I. (2021). The Relationship between Surface and In-Depth Hardness for the Nitrocarburizing Treatment Process. Metals, 11(5), 812. https://doi.org/10.3390/met11050812
- Lukács, J., & Horváth, R. (2022). Comprehensive investigations of cutting with round insert: introduction of a predictive force model with verification. Metals, 12(2), 257. https://doi.org/10.3390/met12020257
- Horváth, R., & Lukács, J. (2017). Application of a Force Model Adapted for the Precise Turning of Various Metallic Materials. Strojniski Vestnik/Journal of Mechanical Engineering, 63(9). https://doi.org/10.5545/sv-jme.2017.4430
- Horváth, R. (2015). A new model for fine turning forces. Acta Polytechnica Hungarica, 12(7), 109-128. https://doi.org/10.12700/APH.12.7.2015.7.7

Date: 2025. September 15.

Prepared by:

Richárd Horváth, PhD

Energy security
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Energy security**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Dr. Péter Kádár	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 80 % - 20 % theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** e.g. case presentations and case study analyses, project work, others... - Theoretical education - Case studies - Plant visit - Student Homework	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: individual report document	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): -	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- Energy Overview - Continental energy networks – energy flows - Fight for natural resources - Hazards - Energy security aspects - Increasing security of supply - Power plant technologies - The Smart Phenomenon - Smart tools, methods - Consumer Influence (DSM) - Integration of renewable energies into VER - System Recovery - Further uncertainties - Nuclear safety - Risks and their management	
Required readings	

Energy security
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

- Dr. Péter Kádár: Doctoral School of Energy Security and Security Sciences; Budapest, 2022
- Virág Török: Hungary's Energy Security Perception in the Light of Its Strategic Documents; Military Science Review, Volume 16 (2023), Issue 2, pp. 107–125. doi: 10.32563/hsz.2023.2.8

Recommended readings

- Roland Dannreuther: Energy security ISBN 9780745661919 Polity Pr 2017
- The Routledge Handbook of Energy Security by Sovacool, Benjamin K., ed. Call Number: 620 /00160; ISBN: 9780415591171; Publication Date: 2011
- Energy security https://energy.ec.europa.eu/topics/energy-security_en

Date: Budapest, 15/08/2025

Prepared by:

Dr. Kádár Péter

Fuzzy Inference Systems and their Applications
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Fuzzy inference systems and their applications**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Dr. Ludányi-Laufer Edit, PhD	
Course classification: Basic course (subjects) in the field of safety and security science/ **Research topic related basic course** / Optional subject (**underline as appropriate!**)	
Proportion of theoretical and practical content, "Training character": 50 % - 50 % theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes (**underline as appropriate, do not change the number of classes!**) **Methods and (specific) approaches, characteristics used to deliver the course content:** e.g. case presentations and case study analyses, project work, others... Theoretical knowledge is presented in lecture form, and then this knowledge is deepened through practical examples. Part of this process is the presentation of case studies, as well as solving software problems in class, and developing a project work related to a research topic. Students have the opportunity to present their project at the Symposium on Fuzzy Based Engineering Systems (SzaFARi), and the submitted papers prepared to an appropriate standard will be published in Bánki Reports.	
Form of assessment (exam / practical grade / other): exam Additional (specific) methods of knowledge assessment: project work	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): none	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
Objective: Fuzzy-based systems are very popular in engineering tasks because they can create an intelligent system that provides an efficient solution to complex or optimization problems. They are able to work with and manage uncertainties, inaccuracies, and subjectivity inherent in data and evaluation, which are difficult to quantify. The aim of the course is to review the fuzzy approach, to get to know its basic concepts and to demonstrate their applicability in engineering Content: Soft computing techniques. Fuzzy logic. Fuzzy logic application in engineering systems, decision making. Traditional set theory. Fuzzy set theory. Basic types and characteristics of fuzzy sets. Operations on fuzzy sets. Fuzzy intersections (t-norms), fuzzy unions (t-norms). Aggregation operators. Implication and inference. Defuzzification methods. Mamdani-type inference system. Takagi-Sugeno model. Hybrid systems. ANFIS model. Fuzzy systems and applications	

Fuzzy Inference Systems and their Applications
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- Rong, HJ., Yang, ZX, „Fuzzy Inference Systems. In: Sequential Intelligent Dynamic System Modeling and Control", Springer, Singapore, 2024, doi: 10.1007/978-981-97-1541-1_1. - J. Dombi, E. Tóth-Laufer, „Reducing the Computational Requirements in the Mamdani-típe Fuzzy Control", Acta Polytechnica Hungarica, vol. 17, no. 3, pp. 25-41, 2020, doi: *10.12700/APH.17.3.2020.3.2*.
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- O. Nelles, "Nonlinear System Identification, From Classical Approaches to Neural Networks, Fuzzy Models, and Gaussian Processes", Second Edition, Springer Nature Switzerland, 2021, DOI: 10.1007/978-3-030-47439-3. - Darko Bozanic, Duško Tešić, et al, Ranking challenges, risks and threats using Fuzzy Inference System, Decision Making: Applications in Management and Engineering, Vol. 6, No. 2, 2023, DOI: https://doi.org/10.31181/dmame622023926. - Mehran Mazandarani, Xiu Lee, Fractional Fuzzy Inference System: The New Generation of Fuzzy Inference Systems, IEEE Access, Vol. 8, DOI: 10.1109/ACCESS.2020.3008064

Date: Budapest, 28.08.2025.

Prepared by:

Prof. Dr. Ludányi-Laufer Edit

Global Security Threats and Trends
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Global Security Threats and Trends**	Credit value: 6
Course responsible and lecturer (name, academic title): Dr. Tibor Babos (Ph.D.), Honorary Professor	
Course classification: Basic course (subjects) in the field of safety and security science/ **Research topic related basic course** / Optional subject	
Proportion of theoretical and practical content, "Training character": 80% theory – 20% practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** The course is conducted through theoretical lectures, analytical case studies, and individual research projects on current global security challenges. It employs comparative analysis, interactive discussion, and strategic scenario-based learning to deepen understanding of contemporary security trends and to strengthen analytical and research competencies.	
Form of assessment (**exam /** practical grade / other): Additional (specific) methods of knowledge assessment: Students prepare an individual presentation and a short research paper on a global security threat selected in consultation with the lecturer. The highest mark may be awarded for a paper resulting in a related publication.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): none	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
The objective of the course is to provide a comprehensive overview of the nature, dynamics, and interconnections of global and regional security challenges. Students explore post–Cold War security trends and the complex interactions among nation-state and transnational threats, including terrorism, migration, hybrid warfare, cyber risks, and climate-related security issues. Special emphasis is placed on the comparative analysis of global, European, and regional security dimensions and on the role of international security architectures such as NATO, the EU, and the United Nations. The course enhances doctoral students' strategic thinking, analytical ability, and research competence within the field of security studies.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

Global Security Threats and Trends
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Babos, T. (2022): Hybrid Threats and the Transformation of European Security. Nemzet és Biztonság, Strategic and Defence Research Center, Budapest.

Babos, T. (2007): Az európai biztonság öt központi pillére. Zrínyi Kiadó, Budapest. ISBN 978-9633274528.

Buzan, B. – Wæver, O. (2020): Regions and Powers: The Structure of International Security. Cambridge University Press.

Nye, J. S. (2022): Do Morals Matter? Presidents and Foreign Policy from FDR to Trump. Oxford University Press.

NATO (2023): Strategic Concept – Madrid Summit 2022. NATO Public Diplomacy Division.

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

Babos, T. (2021): The Global Security Transformation: NATO and the 21st Century Risks. Biztonságtudományi Központ Kiadó, Budapest.

Kiss, J. L. – Sárvári, G. (2023): European Security in Flux: Strategic Autonomy and Transatlantic Relations. Routledge.

Babos, T. (2011): Globális közös terek a NATO-ban. Nemzet és Biztonság, Budapest.

Freedman, L. (2022): Strategy for the Next Century. Penguin Press.

EEAS (2022): EU Strategic Compass for Security and Defence. European Union External Action Service.

Date: 11 September 2025

Prepared by: Tibor Babos (Ph.D.)

<INDUSTRIAL SECURITY IN THE OPERATION OF MILITARY CRITICAL INFRASTRUCTURE ELEMENTS>**COURSE SYLLABUS**

Doctoral School on Safety and Security Sciences

Course title: **Industrial security in the operation of military critical infrastructure elements**	Credit value: 6
Course responsible and lecturer (name, academic title): Norbert DARUKA, habilitate in Military Engineering Sciences PhD.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 60% - 40% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** - case presentations and case study analyses, project work and visiting military critical infrastructures, learning about their operation, examining safety measures.	
Form of assessment (exam / practical grade / other): Oral exam based on material handed in during the study period. Additional (specific) methods of knowledge assessment: Possibility to submit an essay, depending on the number of students, on a given topic.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4.	
Prerequisites (if any): There are no prerequisites for taking the course.	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
The doctoral students should be familiar with the personal, material and organisational conditions for healthy and safe work in the context of organised work in military facilities. Gain knowledge of psychosocial and ergonomic risks. Acquire the ability to think in systems terms and to apply a systems approach to occupational safety and health issues.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Norbert DARUKA: Advanced Tools for the Explosive Materials Identification. NATO Science for Peace and Security Series C: Environmental Security. Springer, pp 455–469.; Dordrecht. https://doi.org/10.1007/978-94-024-2174-3_39; Online ISBN 978-94-024-2174-3. - Norbert DARUKA: Critical Infrastructure Protection in the Production and Use of Explosives Industry Products. NATO Science for Peace and Security Series C: Environmental Security. Springer, pp 297–313.; Dordrecht. https://doi.org/10.1007/978-94-024-2174-3_26; Online ISBN 978-94-024-2174-3.	

- Norbert DARUKA: Options for Implementing Explosion Protection in Critical Infrastructure. In: Kovács, Tünde Anna; Stadler, Róbert Gábor; Daruka, Norbert (szerk.) The Impact of the Energy Dependency on Critical Infrastructure Protection: Proceedings of the 5th International Conference on Central European Critical Infrastructure Protection (ICCECIP 2023), Budapest, Hungary. Cham, Svájc: Springer Nature Switzerland (2025) 765 p. pp. 281-291. Paper: Chapter 22, 11 p. DOI. 10.1007/978-3-031-78544-3_22
- Norbert DARUKA: Critical Infrastructure Risks from Sabotage. In: Kovács, Tünde Anna; Fürstner, Igor (szerk.) Critical Infrastructure Protection: Advanced Technologies for Crisis Prevention and Response, Dordrecht, Hollandia: Springer Netherlands (2025) pp. 129-139. Paper: Chapter 9, 10 p. DOI: 10.1007/978-94-024-2308-2_9
- Norbert DARUKA: The Risks of Insider Attacks on Critical Infrastructure. In: Mirosław, Banasik; Agnieszka, Rogozińska (szerk.) Russian Aggression and European Security, Varsó, Lengyelország: Difin (2024) pp. 142-157., 16 p.

2–5 most important <u>recommended</u> readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- Ferenc KOVÁCS: The strategic role of critical infrastructure in the Russian-Ukrainian war. Hadtudomány 34/3. (2024). pp. 29-39. DOI: 10.17047/HADTUD.2024.34.3.29
- T. A. KOVÁCS - Z. NYIKES – T. BEREK – N. DARUKA – L. TÓTH: Critical Infrastructure Protection in the Light of the Armed Conflicts Cham, Svájc: Springer Nature Switzerland (2024), 534 p. DOI ISBN: 9783031479892, ISBN: 9783031479908.
- T. A. KOVÁCS – R. G. STADLER – N. DARUKA: The Impact of the Energy Dependency on Critical Infrastructure Protection, Cham, Svájc: Springer Nature Switzerland (2025), 765 p. DOI ISBN: 9783031785436 ISBN: 9783031785443

Date: 24.08.2025.

Prepared by:

Norbert DARUKA

INFORMATION SECURITY MANAGEMENT SYTEMS
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Information Security Management Systems**	Credit value: **6**
Course responsible and lecturer (name, academic title): **Pál Michelberger Ph.D. full professor**	
Course classification: Basic course (subjects) in the field of safety and security science/ **Research topic related basic course** / Optional subject	
Proportion of theoretical and practical content, "Training character": **50% - 50% theory - practice**	
Type of class**:** lecture / **seminar** / practice / **consultation** and total number of classes in the given semester: **30 classes** Methods and (specific) approaches, characteristics used to deliver the course content: **project work, development of professional publications on topic of information security management system**	
Form of assessment (exam / practical grade / other): **oral exam** Additional (specific) methods of knowledge assessment: **discussion and explanation of the theses**	
Curricular placement of the course (which semester): **1-4**	
Prerequisites (if any): -	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
The subject supports the foundation of the research topic by presenting the elements of a holistic information security management system. Students participating in the Ph.D course can learn about new research results related to the field, information security standards and recommendations, as well as domestic and international trends in their application. **The relationship between IT and information security; important standards and recommendations applicable in the field (CC, ITIL, ISO/IEC 27001, COBIT, TISAX, NIS2); conditions for the development of integrated (e.g. quality, environmental and information security) management systems; the possibility of integrating business continuity and disaster recovery plans into the management system; overview of relevant research results and literature sources.**	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Jeremy Green , Andy Taylor, David Alexander, Amanda Finch, David Sutton: Information Security Management Principles. British Computer Society. 4th edition (2025) p. 340. ISBN: 9781780176932.	

- Andrea Kő, Gábor Tarján, Ariel Mitev; Information security awareness maturity: conceptual and practical aspects in Hungarian organizations. Information Technology & People 18 December 2023; 36 (8): pp.174–195. https://doi.org/10.1108/ITP-11-2021-0849
- Cees van der Wens: ISO 27001 ISMS Handbook: Implementing and auditing an Information Security Management System in small and medium-sized businesses. Deseo (2023) p.264. ISBN 9798852486288

.

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- Kemendi, Ágnes ; Michelberger, Pál: Process security methods and measurement in the context of standard management systems. ENGINEERING MANAGEMENT IN PRODUCTION AND SERVICES 16 : 2. pp. 148-165. (2024). DOI: https://doi.org/10.2478/emj-2024-0019
- Michelberger, Pál: Integration of Standardised Management Systems. ACTA POLYTECHNICA HUNGARICA 21 : 10. pp. 141-151. (2024). DOI: 10.12700/APH.21.10.2024.10.9
- Ágnes, Kemendi ; Pál, Michelberger ; Agata, Mesjasz-Lech: Industry 4.0 and 5.0–organizational and competency challenges of enterprises. POLISH JOURNAL OF MANAGEMENT STUDIES 26 : 2 pp. 209-232. (2022). DOI:10.17512/pjms.2022.26.2.13

Date: 14.08.2025

Prepared by:

Pál Michelberger Ph.D.

Information security standard theories
SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Information security standard theories**	Credit value: 6
Course responsible and lecturer (name, academic title): Dr. András Kerti	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 100% - 0% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** e.g. case presentations and case study analyses, project work, others... After listening to the lecture, there will be an opportunity to clarify any questions that arise during consultation hours. After studying the material, students will write a summary essay.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: Students can demonstrate their mastery of the course material by writing an essay of approximately one article's length (minimum 20,000 characters, in a format accepted by the doctoral school).	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): *there are none*	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- Within the framework of this course, students will learn about ISO harmonised management standards and related supporting standards, as well as other information security standards such as COBIT Common Criteria and relevant US standards.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- ISO/IEC Directives Part 1 - ISO/IEC 27000 Information technology — Security techniques — Information security management systems — Overview and vocabulary - ISO 31000 Kockázatkezelési irányelvek - Common Criteria	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- **Information Technology Laboratory Computer Security Resource Center:** NIST Special Publications	

- www.isaca.org.

Date: September 9, 2025

Prepared by:

Andras Kerti

Kinematics and kinetics
SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Kinematics and kinetics**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Dr. István Bíró, full professor, PhD	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 50 % - 50 % theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** – Overview of the methods of kinematic and kinetic studies, partly in the form of a lecture, partly in the form of an independent analysis. – Solving a project task related to the student's research topic. – Analysis of publications with similar content.	
Form of assessment (exam / practical grade / other): exam Additional (specific) methods of knowledge assessment: The success of the above work is also included in the results of the colloquium.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): none	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
Aim of the course: Kinematic and kinetic investigation of moving mass points, rigid bodies and structures of rigid bodies including moving kinematical chains applied in human biomechanics. Course description: Kinematics of mass point. Position, velocity, acceleration. Motion equations and diagrams. Kinematical investigation of translational motion of mass points. Circular motion. General plane and spatial motion. Kinematics of rigid bodies. The motion state of rigid bodies. Description of planar and spatial motion of rigid bodies. Degrees of freedom of mechanisms, constructions, classification. Kinetics of mass points. Motion equations of mass points. Impulse, angular momentum, work, energy, power. Constrained motion. Kinetics of rigid bodies. Inertial moment of rigid bodies. The rotation of rigid bodies. Planar and spatial motion of rigid bodies.	

Kinematics and kinetics
SYLLABUS
Doctoral School on Safety and Security Sciences

2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
Dennis S. Bernstein, Ankit Goel, and Ahmad Ansari: GEOMETRY, KINEMATICS, STATICS, AND DYNAMICS, Department of Aerospace Engineering, The University of Michigan Ann Arbor, MI 48109-214 (some chapters) Jens Wittenburg: Kinematics. Theory and Applications. Springer Verlag Berlin Heidelberg 2016, ISBN 978-3-662-48486-9 (some chapters)
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
Duane Knudson: Fundamentals of Biomechanics, 2nd Edition, Springer, 2007, ISBN 978-0-387-49311-4 Andy Ruina and Rudra Pratap: Introduction to Statics and Dynamics, Pre-print for Oxford University Press, 2002 Vladimir M. Zatsiorsky: Kinetics of Human Motion, ISBN: 9780736037785, 2002

Date: 11/09/2025

Prepared by:

Prof. Dr. István Bíró

Material Selection and Investigations for Safety Critical Constructions
SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Material Selection and Investigations for Safety-Critical Constructions**	Credit value: 6
Course responsible and lecturer (name, academic title): Richárd Horváth, PhD	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 70 % - 30 % theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** - providing basic knowledge related to the subject area; - defining a task connected to the research of student topic, based on the knowledge of the course; - completing the defined task with the help of consultations; - if necessary, carrying out and evaluating material investigations.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: - completing the assigned task during the semester;	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): –	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- The aim of the course is to introduce students to the world of traditional and modern material grades. It provides an overview of the characteristics, testing methods, and safety aspects of advanced engineering materials (composites, metamaterials, etc.). - The course presents traditional and modern structural materials used in engineering practice. - Special materials and material structures designed for specific requirements (e.g., high energy absorption) are also introduced. - Students gain insight into different material testing methods. In addition, the importance of selecting the proper material and technology according to the given requirements is emphasized.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Boyer, H. E., & Gall, T. L. (1985). Metals handbook;	

- Bodaghi, M., Damanpack, A. R., Hu, G. F., & Liao, W. H. (2017). Large deformations of soft metamaterials fabricated by 3D printing. *Materials & Design*, *131*, 81-91. doi: https://doi.org/10.1016/j.matdes.2017.06.002
- Zhang, Y., Wang, Y., & Chen, C. Q. (2019). Ordered deformation localization in cellular mechanical metamaterials. *Journal of the Mechanics and Physics of Solids*, *123*, 28-40. doi: https://doi.org/10.1016/j.matdes.2017.06.002

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- Széles, L., Horváth, R., & Réger, M. (2024). Parameter-Independent Deformation Behaviour of Diagonally Reinforced Doubly Re-Entrant Honeycomb. *Polymers*, *16*(21), 3082. https://doi.org/10.3390/polym16213082
- Réger, M., Horváth, R., Fábián, E. R., & Réti, T. (2025). Modelling the Impregnation of a Pressure-Tight Casting. International Journal of Metalcasting, 19(1), 165-175. https://doi.org/10.1007/s40962-024-01272-1
- Széles, L., Horváth, R., & Cveticanin, L. (2024). Research on Auxetic Lattice Structure for Impact Absorption in Machines and Mechanisms. Mathematics, 12(13), 1983. https://doi.org/10.3390/math12131983

Date: 2025. September 15.

Prepared by:

Richárd Horváth, PhD

Materials Science – Special Materials
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Materials Science – Special Materials**	Credit value: 6
Course responsible and lecturer (name, academic title): Mihaly Réger, full professor, DSc	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": …80…% - …20…% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes Methods and (specific) approaches, characteristics used to deliver the course content: A special material group or specific material technology is selected in accordance with the PhD research area. The student prepares an essay-style study, whose main parts include the following: objectives, literature analysis, material property or material technology design, analysis of practical implementation and feasibility, and summary and evaluation.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: Evaluation of the essay-type semester assignment, which may also take place in the form of consultations.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any):	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- The industry requires the use of special metal alloys, plastics, ceramics, and composites developed on the basis of the latest advances in materials science research. The course aims to provide knowledge of the production, properties, and testing methods of modern materials used in mechanical, mechatronic, and safety engineering applications. - The course provides an overview, in line with the specifics of the research area, of the properties of metallic and non-metallic structural materials (e.g. high-strength alloys, functional materials, shape memory alloys, metallic glasses, special ceramics, electronic materials), their material structures (e.g. grain structures, phases, cells, foams, single crystals, layered structures), as well as the material technology aspects of their production. - .	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

Materials Science – Special Materials
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

- Tisza, M.: Az anyagtudomány alapjai, 1. kiadás, Miskolci Egyetemi Kiadó, 2008. Miskolc, ISBN 978-963-661-844-5, pp1-285
- Callister, William D., and David G. Rethwisch. Fundamentals of materials science and engineering. ISBN 1118061608 , John Wiley & Sons, 2022.

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- Porter, D. A., Easterling, K. E., Sherif, M. Y.: Phase Transformation in Metals and Alloys, 4th edition, CRC Press 2022, ISBN-13 978-0367430344,
- Callister, W. D., Rethwisch, D.G: Materials Science and Engineering, an introduction, 10th Ed. Hoboken, NJ: Wiley, 2018, pp1-975. ISBN:13-978-1-119-32159-0
- György, Kaptay. Anyagegyensúlyok makro-, mikro-és nano-méretű rendszerekben. Miskolci Egyetem, 2011. ISBN, 9636619786, 9789636619787, 359 pages.
- https://www.anyagtudomany.eu/

Date: Budapest, 11/09/2025

Prepared by:

Mihaly Reger

Mechanical protection
SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Mechanical protection**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Em. Dr. Berek Lajos László Ph.D.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 60% - 40.% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** e.g. case presentations and case study analyses, project work, others... Lecture using the frontal method, seminar discussing pre-assigned questions with my supervisor.	
Form of assessment (exam / practical grade / other): exam grade Additional (specific) methods of knowledge assessment: The evaluation consists of two parts: firstly, the discussion of the given questions in the seminar, and secondly, the evaluation of a scientific article or conference presentation prepared for the subject.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): (*typically there are none!*) -	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
• The concept of mechanical protection, its main areas, their specificities. • The place of mechanical protection in property protection. • The relationship of mechanical protection with other forms of guarding and protection. • The complexity of guarding and protection. • Mechanical protection of objects, the applied electronic signaling systems, the place and role of manpower in complex guarding and protection.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Dr. Berek Lajos: Biztonságtechnika, NKE, Budapest, 2014. http://vtki.uninke.hu/uploads/media_items/biztonsagtechnika.original.pdf - Dr. Berek Lajos, Dr. Berek Tamás, Berek László: Személy- és vagyonbiztonság, Óbudai Egyetem, Budapest, 2016. ISBN 978-615-5460-94-4	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

- Tóth Attila-Tóth Levente: Biztonságtechnika, NKE, Budapest, 2014. ISBN 978-615-5305-56-6
- Christián L,-Major L,- Szabó Cs [szerk.]: Biztonsági vezetői kézikönyv, Ludovika Egyetemi Kiadó, Budapest, 2020. ISBN 978-963-5310-70-8.
- Horváth T. : Mechanikai védelem, mint késleltetés a fizikai védelemben, NKE Budapest, 2021 In. Hadmérnök p 23–32. ISSN 1788-1919 (online) https://doi.org/10.32567/hm.2021.1.2

Date: 12. september 2025

Prepared by:

Dr. Berek Lajos

Methods and tools for the detection and defusing of explosive devices
SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Methods and tools for the detection and defusing of explosive devices**	Credit value: 6
Course responsible and lecturer (name, academic title): Norbert DARUKA, habilitate in Military Engineering Sciences PhD.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 60% - 40% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** - The options for force protection in the light of the C-IED strategic architecture: weakening and neutralising the terrorist network's attack capability, neutralising the explosive device and reducing its effects, training and preparation. Preparing the population for emergencies. Practical training in explosive device detection tools.	
Form of assessment (exam / practical grade / other): Oral exam based on material handed in during the study period. Additional (specific) methods of knowledge assessment: Possibility to submit an essay, depending on the number of students, on a given topic.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4.	
Prerequisites (if any): There are no prerequisites for taking the course.	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
Students will learn and master the methodology of detection and defusing explosive devices. Be familiar with the standard operating procedures laid down in international standards for counter-explosive device activities. Gain an overview of domestic protection options and international procedures. The information provided in this course can also help students to review and analyse their own research and to prepare their thesis.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- L. KUGYELA – N. DARUKA: Explosive Ordnance Detection in Areas Designated for Mining. Műszaki Katonai Közlöny 34/2024. pp. 129-141. Paper: DOI: 10.32562/mkk.2024.ksz.11 - Norbert DARUKA: The Risks of Insider Attacks on Critical Infrastructure. In: Mirosław, Banasik; Agnieszka, Rogozińska (szerk.) Russian Aggression and European Security, Varsó, Lengyelország: Difin (2024) pp. 142-157. , 16 p. - N. DARUKA – A. CSURGÓ: The use of animals in military operations. In: Beňovský, M (szerk.) Trhacia technika 2017: Zborník prednášok z 29. medzinárodnej konferencie na počesť 390. výročia prvého použitia výbušnín na	

svete v podzemí, Banská Bystrica, Szlovákia: Slovenská spoločnosť pre trhacie a vŕtacie práce (2017) pp. 32-43. , 12 p.
- N. DARUKA – A. CSURGÓ: Military explosive ordnance – The bomb. In: Beňovský, M (szerk.) Trhacia technika 2017: Zborník prednášok z 29. medzinárodnej konferencie na počesť 390. výročia prvého použitia výbušnín na svete v podzemí, Banská Bystrica, Szlovákia : Slovenská spoločnosť pre trhacie a vŕtacie práce (2017) pp. 44-55. , 12 p.

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- N. DARUKA – Z.T. KOVÁCS – I. EMBER: Using search tools to detect military and improvised explosive devices. In: Zborník prednášok : z 33. medzinárodnej konferencie Trhacia Technika 2024. Banská Bystrica, Szlovákia : Slovenská spoločnosť pre trhacie a vŕtacie práce (2024) pp. 15-32.
- N. DARUKA – L SZALKAI: Vehicle explosives and explosive device detection methods at outdoor public events. In: Horváth, Richárd; Lukács, Judit; Stadler, Róbert; Pinke, Péter (szerk.) Mérnöki Szimpózium a Bánkin Előadásai: Proceedings of the Engineering Symposium at Bánki (ESB 2023) Budapest, Magyarország: Óbudai Egyetem (2024) 367 p. pp. 186-191.
- N. DARUKA – L SZALKAI: Detection of explosives and explosive devices current issues. In: Németh, Kornél; Jakab, Bálint; Péter, Erzsébet (szerk.) VIII. Turizmus és biztonság nemzetközi tudományos konferencia tanulmánykötet, Veszprém, Magyarország: Pannon Egyetemi Kiadó (2024) 514 p. pp. 436-448.

Date: 24.08.2025.

Prepared by:

Norbert DARUKA

Metrology and Data Evaluation
SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Metrology and Data Evaluation**	Credit value: 6
Course responsible and lecturer (name, academic title): Ágota DRÉGELYI-KISS, PhD, habil.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": …40…% - …60...% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** - Problem-based learning, project work - Interdisciplinary approach: linking metrology to the field of research - Data processing exercises: using Python, Jamovi, R, Minitab, or other statistical methods	
Form of assessment (exam / practical grade / other): oral exam Additional (specific) methods of knowledge assessment: Students are required to prepare a study on data evaluation and processing, demonstrating their ability to apply the concepts and methods covered in the course.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any):	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
During the course, students will become familiar with the fundamental concepts of metrology and the current requirements for legally regulated measurements relevant to their research work. They will gain in-depth knowledge of measurement standards and traceable measurements, enabling them to ensure the accuracy and reliability of their conclusions when evaluating measurement results. Throughout their research, students will encounter various types of data, whether measurement-based or classified, and extracting the maximum amount of information from these data requires the use of univariate and multivariate statistical methods. Within the scope of this course, students will explore the details of statistical evaluation with the support of computer-based software such as Minitab, Statistica, SPSS, SAS, R, Python, or Jamovi.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Rosario, PPP and Mendes, A (2025): Metrology and Measurement Uncertainty, Springer, https://doi.org/10.1007/978-3-031-82303-9	

- Placko, D. (2013). Metrology in industry: The key for quality. John Wiley & Sons. DOI:10.1002/9780470612125
- Brown, R. J. (2021). Measuring measurement–What is metrology and why does it matter?. Measurement, 168, 108408.
- Danielle J. Navarro and David R. Foxcroft, Learning Statistics with jamovi: A Tutorial for Beginners in Statistical Analysis. Cambridge, UK: Open Book Publishers, 2025, https://doi.org/10.11647/OBP.0333 .

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- BIPM, IEC, IFCC, ILAC, ISO, IUPAC, IUPAP, and OIML. International Vocabulary of Metrology—Basic and general concepts and associated terms (VIM). Joint Committee for Guides in Metrology, JCGM 200:2012. (3rd edition). doi:10.59161/JCGM200-2012.
- BIPM, IEC, IFCC, ILAC, ISO, IUPAC, IUPAP, and OIML. Evaluation of measurement data — Guide to the expression of uncertainty in measurement. Joint Committee for Guides in Metrology, JCGM 100:2008. doi:10.59161/JCGM100-2008E.
- Montgomery, D. C., & Runger, G. C. (2020). Applied statistics and probability for engineers. John wiley & sons.

Date: 07/09/2025

Prepared by:

Ágota DRÉGELYI-KISS

Model studies of maintenance processes
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: Model studies of maintenance processes	Credit value: 6
Course responsible and lecturer (name, academic title): Pokorádi, László, CSc (technical science)	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 50 % - 50.% theory - practice	
Type of class: lecture / seminar / practice / **consultation** and total number of classes in the given semester: 30 **Methods and (specific) approaches, characteristics used to deliver the course content:** e.g. case presentations and case study analyses, project work, others... case presentations and/or case study analyses	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: making of a summary study	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): are not	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- .theoretical background of maintenance; operation strategies; - stochastic analysis of maintenance processes; - methods for setting up maintenance models and their application; - modeling of maintenance with a Markov process (Markov chain, Markov type queuing model).	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN): (**should be recent, from the last 3–5 years, can include academic publications**)	
- Riccardo Manzini, Alberto Regattieri, Hoang Pham, Emilio Ferrari, Maintenance for Industrial Systems, Springer-Verlag, London, 2022. ISBN 13: 9781447125235 - Jan Pukite, Paul Pukite, Markov Modeling for Reliability, Maintainability, Safety, and Supportability Analyses of Complex Computer Systems, IEEE PRESS, 1998., pp. 288., ISBN: 978-0780334823 - Toshio Nakagawa, Maintenance Theory of Reliability, Springer London, pp. 270., ISBN: 9781846282218	

Model studies of maintenance processes
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- Ushakov, “Handbook of Reliability Engineering”, John Wiley & Sons, 1994. ISBN: 978-0-471-57173-5 - Bauer, E., Zhang, X., Kimber D.A., “Practical System Reliability”, John Wiley & Sons, 2009. ISBN 978-0470-40860-5 - Myers, ”Complex System Reliability” Springer-Verlag, 2010. ISSN 1614-7839

Date: 15.09.2025.

Prepared by: ……

Pokorádi, László

Modern Control Engineering in Mechatronics
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Modern Control Engineering in Mechatronics**.	Credit value: 6.
Course responsible and lecturer (name, academic title): Prof. Dr. Róbert Szabolcsi, DSc.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 40% - 60% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes. **Methods and (specific) approaches, characteristics used to deliver the course content:** After theoretical lectures delivered students start to work over their individual scientific projects.	
Form of assessment (exam / practical grade / other): 'Exam'. Additional (specific) methods of knowledge assessment: at the end of the course students prepare presentations with their main results, and write a summary essay. MATLAB scripts prepared by the students are evaluated for correctness.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4.	
Prerequisites (if any): —	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- Advanced mechatronical systems. - System analysis and design. preliminary design. - Enhanced control engineering in automotive industry. - Solution of control problems of road transportation. - Solution of control problems in rail transportation. - Solution of control problems in aviation. - Robot control. - Dynamical system design in time and in frequency domains. - Solution of problems of transportation engineering using MATLAB.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Szabolcsi, R.: Control System Design using MATLAB®, ISBN 9789634491873. Budapest, Óbuda University, 396 p., 2020. - Ali Mahmood; Róbert Szabolcsi: A Systematic Review on Risk Management and Enhancing Reliability in Autonomous Vehicles. Machines, ISSN 2075-1702, 13 646, pp(1-19), 2025. - Al-bayati Karrar Y. A.; Mahmood Ali; Szabolcsi Róbert: Robust Path Tracking Control with Lateral Dynamics Optimization: A Focus on Sideslip Reduction and Yaw Rate Stability Using Linear Quadratic Regulator and Genetic Algorithms. Vehicles, ISSN 2624-8921, 7 2, 16 p., 2025.	

- MATLAB 2025b, User's Guide, The MathWorks Ltd., 2025.
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- Jameel Al-Kamil Safa; Szabolcsi Róbert: Optimizing path planning in mobile robot systems using motion capture technology. Results in Engineering, (2590-1230 2590-1230): Vol 22 Paper 102043. 9 p., 2024. - Al-Kamil Safa Jameel; Szabolcsi Róbert: Enhancing Mobile Robot Navigation: Optimization of Trajectories through Machine Learning Techniques for Improved Path Planning Efficiency. Mathematics (2227-7390): 12 12, pp(1787-1807), 2024. - Ahmed Douzi; Róbert Szabolcsi; Judit Lukács: Cybersecurity and the flight safety of unmanned aerial systems and unmanned aerial vehicles Interdisciplinary Description of Complex Systems (1334-4684 1334-4676): 23 2 pp(95-104), 2025.

Date: August 28 2025, Budapest, Hungary.

Prepared by:

Prof. Dr. habil. Róbert Szabolcsi, DSc.

Modern technical diagnostics
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Modern technical diagnostics**	Credit value: 6
Course responsible and lecturer (name, academic title):József Zoltán Dr. Szabó PhD	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 40% - 60% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** Case reports and case study processing, project work, independent task development based on case studies	
Form of assessment (exam / practical grade / other): exam Additional (specific) methods of knowledge assessment: Oral exam	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): -	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- - To introduce the traditional maintenance strategies and modern operating philosophies of high-value machines and production equipment. - - To introduce modern diagnostic methods related to the safe operation and maintenance of machines - - To introduce the application possibilities of modern diagnostic instruments. - - To introduce new research results in the field.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- . Gaál Z. – Kovács Z.: Megbízhatóság – Karbantartás, Egyetemi Kiadó, Veszprém, 1994. - Scheffer-P.Girdhar: Practical Machinery Vibration Analysis & Predictive Maintenance , Verlag: Newnes 2004) - Szerk: Dr. Dömötör Ferenc : Rezgésdiagnosztika I. - Dunaújvárosi Főiskola Kiadói Hivatala, Dunaújváros 2008. ISBN 978-96387780-0-0 - Szerk: Dr. Dömötör Ferenc : Rezgésdiagnosztika II. - Dunaújvárosi Főiskola Kiadói Hivatala, Dunaújváros 2011. ISBN 978-963-9915-43-5 - R.Keith Mobley: Vibration fundamentals (Newnes 2000).	

Modern technical diagnostics
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- Dr. Szabó József Zoltán: Műszaki diagnosztikai módszerek; Egyetemi jegyzet ÓE-BGK-3068, 2015. - M.Norton, D.Karczub: Fundamentals of Nois and Vibration Analysis for Engineers (Cambridge University Press 2003)

Date: 2025. szeptember 10.

Prepared by:

József Zoltán Dr. Szabó PhD>

Modern Techniques and Their Engineering Applications
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Modern Techniques and Their Engineering Applications**	Credit value: 6
Course responsible and lecturer (name, academic title): Judit Dr. LUKÁCS	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 70% - 30% theory – practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** Presentation of research, case studies, project work.	
Form of assessment (exam / practical grade / other): oral exam Additional (specific) methods of knowledge assessment: -	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): -	
Course description: The aim of the course is to introduce students to the basics of soft computing methods. Its fundamental goal is to extend the limits of mathematical modeling problems that also occur in engineering systems and to familiarize students with soft methods.	
- The main topics of biologically inspired systems, such as fuzzy logic, neural networks, and genetic algorithms, will be presented. - Students will gain insight into the possibilities offered by these systems and the interpretation and management of uncertainty. - The modeling and evaluation possibilities of soft computing methods will be presented.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Peckol, J. K. (2021). *Introduction to fuzzy logic*. John Wiley & Sons. - Prince, S. J. (2023). *Understanding deep learning*. MIT press. - Indrakumari, R., Poongodi, T., & Singh, K. (2021). Introduction to deep learning. In *Advanced deep learning for engineers and scientists: a practical approach* (pp. 1-22). Cham: Springer International Publishing.	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Péczka, P. (2024). Soft computing methods in audit. *Bánki Reports*, *6*(1), 33-38. - Forgács, A., Lukács, J., Csiszárik-Kocsir, Á., & Horváth, R. (2024). Towards the Investigation of Online Shopping Behaviours Using a Fuzzy Inference System. *Decision Making: Applications in Management and Engineering*, *7*(2), 337-354.	

Modern Techniques and Their Engineering Applications
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Date: 11 September 2025

Prepared by:

Judit Dr. LUKÁCS

Motion analysis in biomechanics
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Motion analysis in biomechanics**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Dr. István Bíró, full professor, PhD	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 50 % - 50 % theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** – Overview of the methods of motion analysis applied in biomechanics, partly in the form of a lecture, partly in the form of an independent analysis. – Solving a project task related to the student's research topic. – Analysis of publications with similar content.	
Form of assessment (exam / practical grade / other): exam Additional (specific) methods of knowledge assessment: The success of the above work is also included in the results of the colloquium.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): (*typically there are none!*) none	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
Aim of the course: The aim of the course is the deeper understanding of the biomechanics of human motion in sports and rehabilitation. During the investigation of different human motion, processing of a large number of kinematical data is necessary. Different type of motion capture systems, equipments and methods such as optical, electromagnetic and image-based techniques can be applied. For deeper investigation, the processing of measured data is necessary to calculate various special kinematic and kinetic parameters. In these cases the application of special mathematical tools are indispensable. **Course description:** Review and analytical evaluation of different mathematical tools can be applied motion analysis. The 2nd part of the content of the course is the application of some reviewed and evaluated mathematical tools in own research topic.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

Motion analysis in biomechanics
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Iwan W. Griffiths: Principles of biomechanics & motion analysis. Lippincott Williams & Wilkins, 2006, ISBN 0-7817-5231-0, 2006 Jaehwang Seol, Kicheol Yoon and Kwang Gi Kim: Mathematical Analysis and Motion Capture System Utilization. Method for Standardization Evaluation of Tracking Objectivity of 6-DOF Arm Structure for Rehabilitation Training Exercise Therapy Robot, Diagnostics, 2022, 12, 3179. https://doi.org/ 10.3390/ diagnostics12123179
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
Duane Knudson: Fundamentals of Biomechanics, 2nd Edition, Springer, 2007, ISBN 978-0-387-49311-4 Vladimir M. Zatsiorsky: Kinetics of Human Motion, ISBN: 9780736037785, 2002 Bíró István, Fekete Gusztáv: Approximate Method for Determining the Axis of Finite Rotation of Human Knee Joint, ACTA POLYTECHNICA HUNGARICA 11:(9) pp. 61-74. (2014) G Fekete, B M Csizmadia, M A Wahab, P Baets, L Vanegas-Useche, I Biro: Patellofemoral Model of the Knee Joint Under Nonstandard Squatting, DYNA-COLOMBIA 81:(183) pp. 60-67. (2014) István Bíró, Béla M. Csizmadia, Gábor Katona: Sensitivity investigation of three-cylinder model of human knee joint, BIOMECHANICA HUNGARICA 3:(1) pp. 33-42. (2010)

Date: 11/09/2025

Prepared by:

Prof. Dr. István Bíró

Protection of special objects
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Protection of special objects**	Credit value: 6
Course responsible and lecturer (name, academic title): Dr. Tamás BEREK (PhD)	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 60% - 40.% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** e.g. case presentations and case study analyses, project work, others... Lecture using the frontal method, seminar discussing pre-assigned questions with my supervisor.	
Form of assessment (exam / practical grade / other): exam grade Additional (specific) methods of knowledge assessment: The evaluation consists of two parts: firstly, the discussion of the given questions in the seminar, and secondly, the evaluation of a scientific article or conference presentation prepared for the subject.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): (*typically there are none!*) -	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
• The concept of a special object, its main types, and its characteristics. • The place of protection of special objects in property protection. • Guarding and protection of special objects. • The complexity of guarding and protection. • Mechanical protection of special objects, the applied electronic signaling systems, the place and role of manpower in complex guarding and protection.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
– Saunders, M. N. K., Lewis, P., & Thornhill, A. (2023). Research methods for business students (Ninth edition). Pearson. ISBN: 978-1-292-40274-1 – Pearson. (2023). Student Resources | Saunders, Thornhill, Lewis, Research Methods for Business Students, 9/e. https://media.pearsoncmg.com/intl/ema/ema_uk_he_saunders_resmeths_9/cw/index.php – Thiel, D. V. (2014). Research Methods for Engineers (1st ed.). Cambridge University Press. https://doi.org/10.1017/CBO9781139542326, ISBN: 978-1-107-03488-4	

Protection of special objects
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- Li, J., Qiu, Y., Wei, F. Y., & Jiang, R. S. (2014). Research on conceptual design selection based on engineering science. Adv. Mater. Res., 1056, 186–189. https://doi.org/10.4028/www.scientific.net/AMR.1056.186
- Novikov, A. M., & Novikov, D. A. (2013). Research methodology: From philosophy of science to research design. CRC Press. ISBN: 978-0-203-76472-5
- Rincon Soto, I. B., Soledispa-Cañarte, B. J., Sumba-Bustamante, R. V., del Carmen Burbano-Gómez, Z., & Jiménez-Granizo, F. P. (2023). Methodological Approaches and Paradigms in Scientific And technological Research: A Bibliometric Review. Bibliotecas, Anales de Investigacion, 19(1), 50–60.

Date: 12. september 2025

Prepared by:

Dr. Berek Tamás

Qualitative Research Methods and Analysis
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Qualitative Research Methods and Analysis**	Credit value: 6
Course responsible and lecturer (name, academic title): Dr. habil. Anikó Kelemen-Erdős	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 30% - 70% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** Based on qualitative research methodology and theoretical foundations individual secondary and qualitative research, and publication.	
Form of assessment (exam / practical grade / other): practical grade Additional (specific) methods of knowledge assessment: the student's research documentation and publications is assessed	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): –	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- The aim of the course is to provide a basis for doctoral research. The basic aim is to introduce innovative research methodologies that provide novelty in the approach to a given research topic and allow for individual adaptation. A further objective is to promote the theoretical and practical application of qualitative scientific research analysis. - Characteristics of qualitative research. The research process: problem formulation, approach, research design, data collection, data preparation, data analysis using qualitative research as an example. - Qualitative research methodology: in addition to classical qualitative research methods (interview techniques), innovative methods: netnography, narrative techniques, projective techniques, use of metaphors, collage techniques, image association. - Qualitative research analysis: content analysis, grounded theory, case study. - Publication of research findings.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

Qualitative Research Methods and Analysis
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

- Okoko, Janet Mola; Tunison, Scott; Walker, Keith D. (2023): Varieties of Qualitative Research Methods: Selected Contextual Perspectives, Springer, ISBN: 3031043944, 9783031043949.
- Tisdell, E. J., Merriam, S. B., & Stuckey-Peyrot, H. L. (2025). Qualitative research: A guide to design and implementation. 5th edition, John Wiley & Sons. ISBN-13: 978-1394266449, ISBN-10: 1394266448.

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- Savin-Baden, Maggi; Major, Claire Howell (2023): Qualitative Research: The Essential Guide to Theory and Practice. Routledge, London, ISBN: 9781003377986.
- Mészáros, A. Á., Kelemen-Erdős, A. (2023). Industrial espionage from a human factor perspective. Journal of International Studies,16(3), pp. 97-116. doi:10.14254/2071-8330.2023/16-3/5.
- Kelemen-Erdős A., Ma, L. (2024): Customer perceptions about traceable meat: Research from Northern China. Food Research 8(5), pp. 324-333. doi: 10.26656/fr.2017.8(5).292.

Date: 2. September 2025.

Prepared by:

Dr. habil. Anikó Kelemen-Erdős

Regulation and Institutional System of Occupational Safety in the European Union and Hungary
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Regulation and Institutional System of Occupational Safety in the European Union and Hungary**	Credit value: 6
Course responsible and lecturer (name, academic title): **dr. habil Szabó Gyula**	
Course classification: Basic course (subjects) in the field of safety and security science/ **Research topic related basic course** / Optional subject	
Proportion of theoretical and practical content, "Training character": **70% theory – 30% practice**	
Type of class: lecture / seminar / practice / **consultation** and total number of classes in the given semester: 30 classes Methods and (specific) approaches, characteristics used to deliver the course content: **Case presentations and case study analyses, legal regulation analysis, project work, comparative system analysis.**	
Form of assessment (exam / **practical grade** / other) Additional (specific) methods of knowledge assessment: **Students must, within a regulatory area matching their research interest, provide an essay-type evaluation of the transposition of European occupational safety regulations and present a compliance table demonstrating Hungarian specificities.**	
Curricular placement of the course (which semester): Can be taken in semesters **1–4**	
Prerequisites: **none**	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
The aim of the course is to enable students to navigate the system of European and Hungarian occupational safety regulation. After processing the Framework Directive on occupational safety and health, students will learn about the institutions and actors involved in regulation. The course addresses in detail the regulation of workplaces, equipment, signals, and personal protective equipment, as well as the risks posed by chemical, physical, and biological agents, in addition to provisions on ergonomic and psychosocial risks. It also covers sector-specific and worker-related regulations. The course is based on EU and Hungarian legislation, while also providing an outlook to the occupational safety systems of the United States and Australia.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
• .Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work ("Framework Directive") • Act XCIII of 1993 on Occupational Safety (Mvt.), consolidated with Decree 5/1993 (XII.26.) of the Ministry of Labour • Legal regulations processed during the course	

Regulation and Institutional System of Occupational Safety in the European Union and Hungary
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

2–5 most important <u>recommended</u> readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- Hungarian legislation: http://njt.hu/ - EU legislation: http://eur-lex.europa.eu/ - European Agency for Safety and Health at Work (EU-OSHA): https://osha.europa.eu - OSHwiki knowledge base: https://oshwiki.eu/wiki/Main_Page - Lesfalvi, Tibor: Occupational Safety Law and Procedural Knowledge, Óbuda University

Budapest, 21 August, 2025

Prepared by:

Dr. habil Gyula Szabó

Research on Critical Infrastructure Protection
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Research on Critical Infrastructure Protection**	Credit value: 6
Course responsible and lecturer (name, academic title): Tibor Babos (Ph.D.), Honorary Professor	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 80% theory – 20% practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** he course is delivered through theoretical lectures, case study analysis, research-based project work, simulation analyses, small-group presentations, and interdisciplinary discussion forums. Students engage in the scientific and practical aspects of critical infrastructure protection, resilience strategies, and emerging threats.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: Students prepare an individual presentation and a short research-based paper on a current aspect of critical infrastructure protection in a research area designated by the instructor. The highest grade may be awarded for work that results in a relevant publication.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): -	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
This course aims to provide Ph.D. students with in-depth, systemic, and research-oriented knowledge in the multidisciplinary field of critical infrastructure protection. Building on the EU Directive 2008/114/EC and the European Parliament and Council Directive 2022/2557 (CER), the course examines the protection of physical and cyber components of critical infrastructures, new-generation threats, and the scientific and practical aspects of resilience-based approaches. The central objective is to synthesize internationally available knowledge and develop innovative research models that contribute to the protection of populations, economies, and national sovereignty in an era of hybrid, cyber, environmental, and technological threats. Within the course framework, students explore the following research areas: Modeling vulnerabilities of critical infrastructure systems (energy, water, transport, communication, healthcare, etc.)	

Innovative technological solutions for integrated protection of physical and cyber infrastructure The role of artificial intelligence, Big Data, and digital twins in critical infrastructure protection Theory and practice of resilient, self-diagnosing, and self-healing systems Civil–military cooperation and coordination mechanisms at national, EU, and NATO levels Application of cost-efficiency and systems-theory models in research practice Upon completing the course, students will be able to: Identify and assess threats to critical infrastructures Model the protection of complex systems with academic rigor Contribute through research to the development of national and European security strategies
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
Babos, T. (2023): Resilient Systems and Critical Infrastructure Protection in the Age of Hybrid Threats. Nemzet és Biztonság, Strategic and Defence Research Centre, Budapest. Nádai, L. & Padányi, J. (eds.) (2014): Critical Infrastructure Protection Research: Results of the First Critical Infrastructure Protection Project in Hungary. Óbuda University, Springer, Budapest. ISBN 978-3-319-28090-5. Lewis, T. G. (2022): Critical Infrastructure Protection in Homeland Security: Defending a Networked Nation. 3rd ed., Wiley, Hoboken, NJ. ISBN 978-1-118-98823-0. Kröger, W. & Nan, C. (2020): Resilience and Risk: Methods and Application in Critical Infrastructure Protection. Springer, Cham. ISBN 978-3-030-45071-4. European Commission (2022): Directive (EU) 2022/2557 on the Resilience of Critical Entities (CER Directive). Official Journal of the European Union.
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
Babos, T. (2021): Security Innovation and Infrastructure Resilience in the Digital Era. Biztonságtudományi Központ Kiadó, Budapest.

Edwards, M. (ed.) (2021): Critical Infrastructure Protection XIII. IOS Press, Amsterdam. ISBN 978-1-64368-152-4.

Butts, J. & Shenoi, S. (eds.) (2020): Critical Infrastructure Protection XIV. Springer, Heidelberg. ISBN 978-3-030-58702-1.

CISA (2023): National Infrastructure Protection Plan (NIPP 2023) – Partnering for Security and Resilience. U.S. Department of Homeland Security, Washington, D.C.

OECD (2024): AI and Cyber Resilience in Critical Infrastructure Systems. OECD Publishing, Paris.

Date: 19 October 2025

Prepared by:
Tibor Babos (Ph.D.)

Risk analysis methodology
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Risk analysis methodology**	Credit value: 6
Course responsible and lecturer (name, academic title): Dr. András Kerti	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 30% - 70% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** e.g. case presentations and case study analyses, project work, others... During the theoretical part of the course, students learn about the basics of risk management, the relevant regulatory documents (standards, legislation), and the methodology. During the practical part of the course, students perform a risk analysis of a fictitious company, which we then analyze together during the consultation.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: Students can demonstrate their mastery of the course material by writing an essay of approximately one article's length (minimum 20,000 characters, in a format accepted by the doctoral school).	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): *there are none*	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
After completing the course, doctoral students will: - Be familiar with risk analysis standards and various risk analysis methods based on ISO/IEC 31010. The information security risk analysis process using ISO/IEC 27005. - Be able to perform a comprehensive risk analysis for a medium-sized enterprise.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- **ISO 31000:2018** Risk management. Guidelines - **EN IEC 31010:2020** Risk management. Risk assessment techniques (IEC 31010:2019) - **MSZ EN ISO/IEC 27005:2022** (Information security, cybersecurity and privacy protection. Guidance on managing information security risks (ISO/IEC 27005:2022))	

Risk analysis methodology
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):
- **Information Technology Laboratory Computer Security Resource Center:** NIST Special Publication 800-37 Revision 2 Risk Management Framework for Information Systems and Organizations - **Information Technology Laboratory Computer Security Resource Center:** NIST Special Publication NIST SP 800-221A Information and Communications Technology (ICT) Risk Outcomes

Date: September 9, 2025

Prepared by:

Dr. habil. Kerti András

Road Safety
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Road Safety**	Credit value: 6
Course responsible and lecturer (name, academic title): Judit Dr. LUKÁCS	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 70% - 30% theory – practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** Presentation of research, case studies, project work.	
Form of assessment (exam / practical grade / other): oral exam Additional (specific) methods of knowledge assessment: -	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): -	
Course description: The aim of the course is to introduce students to the safety aspects and issues of road transport. It provides an overview of the most important factors in the transport environment, as well as the effects to be observed when assessing safety standards and those to be emphasized when improving them. - The most important issues in transport planning and transport organization are presented, including the most important traffic engineering parameters and the possibilities for measuring, estimating, and regulating them. - The human-vehicle-environment triangle and the possibilities offered by modern driver assistance systems will be described. - Students will gain insight into the process of investigating road accidents, from on-site inspection to accident reconstruction..	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN): - Struble, D. E., & Struble, J. D. (2020). *Automotive accident reconstruction: practices and principles*. CRC Press. - Lord, D., Qin, X., & Geedipally, S. R. (2021). *Highway safety analytics and modeling*. Elsevier. - Noy, Y. I. (Ed.). (2020). *Ergonomics and safety of intelligent driver interfaces*. CRC Press.	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN): - Jiao, B., & Evdorides, H. (2024). Methods of strategic road safety management: a systematic review. *International journal of injury control and safety promotion*, *31*(3), 420-430.	

- World Health Organization. (2023). *Pedestrian safety: a road safety manual for decision-makers and practitioners*. World Health Organization.
- World Health Organization. (2022). *Powered two-and three-wheeler safety: a road safety manual for decision-makers and practitioners*. World Health Organization.

Date: 11 September 2025

Prepared by:

Judit Dr. LUKÁCS

Safety against brittle fracture
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Safety against brittle fracture**	Credit value: 6
Course responsible and lecturer (name, academic title): Prof. Dr. habil. Tünde Anna Kovács, PhD., habil., Professor	
Course classification: Basic course (subjects) in the field of safety and security science/ **Research topic related basic course** / Optional subject	
Proportion of theoretical and practical content, "Training character": 70 % - 30.% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** Following the theoretical foundation of the curriculum, case studies are analyzed and practical brittle fracture cases are reviewed. During the theoretical foundation, students learn about the brittle fracture tendency and its characteristics for each type of material. This is followed by the analysis of case studies, the causes of brittle fracture events, and the analysis of brittle fracture fracture surfaces.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: Report based on literature research and practical experience, analysis of a case of bone fracture.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): none	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
• Study of the ductile brittle behaviour of materials, analysis of the fracture process, stable and unstable crack propagation. In crack initiation, it is necessary to assume that all materials in practice contain defects and to investigate the conditions under which these defects iniciate to propagate in an unstable or catastrophic manner. • Fracture mechanics theories for crack fractures are based on Neuber, Griffith (linear elastic fracture mechanics, LRTM) and Irwin-Orowan (stress intensity factor, K), small ductile range fracture mechanics, Wells (critical crack opening COD or δc theory), followed by the analysis of the relationship between δc and KIC, Rice (J integral theory), Czoboly-Radon relation for small radius of curvature notches	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- F. Gillemot, E. Czoboly, I. Havas, Fracture mechanics applications of absorbed specific fracture energy: Notch and unnotched specimens, Theoretical and Applied Fracture Mechanics, Volume 4, Issue 1, doi:10.1016/0167-8442(85)90041-2.	

- ASM Handbook 19, Fatigue and Fracture, 1996, ASM International ISBN 0-87170-385-8
- J Weertman: Fracture mechanics: A unified view for Griffith-Irwin-Orowan cracks, Acta Metallurgica, Volume 26, Issue 11, 1978, Pages 1731-1738, ISSN 0001-6160, https://doi.org/10.1016/0001-6160(78)90084-6.

2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):

- Bahram Farahmand, Ph.D: Fracture Mechanics of Metals, Composites, Welds, and Bolted Joints Application of LEFM, EPFM, and FMDM Theory, Kluwer Academic Publishers, 2001.
- Kenneth A. Macdonald: Fracture and fatigue of welded joints and structures, Woodhead Publishing Limited, 2011.
- P.J.G. Schreurs: Fracture Mechanics, Eindhoven University of Technology Department of Mechanical Engineering Materials Technology September 6, 2012

Date: Budapest, 2025.08.15.

Prepared by:

Prof. Dr Tünde Kovács

Technical and Technological Aspects of Fire Safety
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Technical and Technological Aspects of Fire Safety**	Credit value: 6
Course responsible and lecturer (name, academic title): Dr. habil. Rudolf Nagy	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 50% - 50% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** project work.	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: Students' knowledge of the subject is assessed through reports or written project work based on the evaluation of study plans.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): —	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- Technical analysis of factors related to fire hazards and fire safety. Investigation of the chemical, physical, and thermodynamic processes involved in fire development. Identification of the technical and engineering causes of fires. Identification of active and passive technical solutions necessary for the prevention of damage caused by activities involving fire-hazardous materials. Research into the development of the technical capabilities of technical devices used to eliminate the consequences of accidents. Development of a methodology for averting damage events that can cause fire-hazardous conditions.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- NFPA 1033 Standard for Professional Qualifications for Fire Investigator 2022 Edition - Mihir Kumar Purkait, et al: Hazards and Safety in Process Industries, ISBN: 978-0-367-51651-2, 2021.	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Hetyei Cs. – Nagy R.: Review of Wind Turbine Failures, Highlighting Fire Accidents, Műszaki Katonai Közlöny, 2020.	

- Krepuska A. – Nagy R.: Study of the technical requirements of functionality retention cable systems, Védelem Tudomány: Katasztrófavédelmi Online Tudományos Folyóirat, 2022.

Date: Budapest, September 10, 2025.

Prepared by:

Dr. habil. Nagy Rudolf

Technical reliability
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Technical reliability**	Credit value: 6
Course responsible and lecturer (name, academic title): Pokorádi, László, CSc (technical science)	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 50 % - 50.% theory - practice	
Type of class: lecture / seminar / practice / **consultation** and total number of classes in the given semester: 30 **Methods and (specific) approaches, characteristics used to deliver the course content:** e.g. case presentations and case study analyses, project work, others... case presentations and/or case study analyses	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment: making of a summary study	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): are not	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
- reliability fundamentals; - reliability issues of elements and systems; - Fault tree analysis (FTA); - Event tree analysis (ETA); - Ishikawa analysis; Failure mode and effects analysis (FMEA); - Pareto analysis.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Ushakov, "Handbook of Reliability Engineering", John Wiley & Sons, 1994. ISBN: 978-0-471-57173-5 - Bauer, E., Zhang, X., Kimber D.A., "Practical System Reliability", John Wiley & Sons, 2009. ISBN 978-0470-40860-5 - Myers, "Complex System Reliability" Springer-Verlag, 2010. ISSN 1614-7839	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN): (**should be recent, from the last 3–5 years, can include academic publications**)	

- Pokorádi, László, Monte-Carlo Simulation of Reliability of System with Complex Interconnections, VEHICLES 6 : 4 pp. 1801-1811. , 11 p. (2024)
- Pokorádi, L., Probabilistic Uncertainty Analysis of Reliability of Systems with Complex Interconnections, JOURNAL OF PHYSICS-CONFERENCE SERIES 1935 : 1 Paper: 012007 , 14 p. (2021)
- Pokorádi, László, Sensitivity analysis of reliability of Systems with Complex Interconnections, JOURNAL OF LOSS PREVENTION IN THE PROCESS INDUSTRIES 32 pp. 436-442. , 7 p. (2014)

Date: 15.09.2025.

Prepared by:

Pokorádi, László

Theory and practice in the production, use and handling of explosives materials and products
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Theory and practice in the production, use and handling of explosives materials and products**	Credit value: 6
Course responsible and lecturer (name, academic title): Norbert DARUKA, habilitate in Military Engineering Sciences PhD.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": 60% - 40% theory - practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** - Preparation for the demolition of buildings, mining, flood protection and disaster management facilities.	
Form of assessment (exam / practical grade / other): Oral exam based on material handed in during the study period. Additional (specific) methods of knowledge assessment: Possibility to submit an essay, depending on the number of students, on a given topic.	
Curricular placement of the course (which semester): Can be taken in semesters 1–4.	
Prerequisites (if any): There are no prerequisites for taking the course.	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
To familiarise students with the characteristics of blasting in construction, mining, flood protection and disaster management, the explosives used and the methods and procedures of blasting. The information provided in the course may also help doctoral students to review and analyse their own research and to prepare their thesis.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Dr. Bohus G. – Horváth L. – Papp J.: Ipari robbantástechnika. Műszaki Könyvkiadó, Budapest, 1983. - Benedek D. – Horváth L. – Kánnár T. – Skublics G. – Szabó P. Á.: Robbantómesterek kézikönyve I., OMBKE 1987. - Benedek D. – Horváth L. – Kirschner J. – Rozsnyói P. – Schelly P.: Robbantómesterek kézikönyve II., OMBKE 1989.	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

- Á. BUNYITAI – N. DARUKA: Comparison of industrial demolition by explosive demolition, military destruction and criminal damage to structures. TECHNICAL MILITARY BULLETIN 33/4 (2023), pp. 5-19. DOI: 10.32562/mkk.2023.4.1
- Beáta SZARVAS: The benefits of water-filled structures demolition by blasting. Military Logistics 3/2020. PP. 149-164. DOI: 10.30583/2020.3.149
- Zsuzsanna BALOGH: Glass and blast - the architectural dilemma. In: New Challenges in the Field of Military Sciences 2010: 7th international conference 2010, Budapest: Bolyai János Honvéd Alapitvány (2010) 500 p. pp. 1-10. , 10 p.

Date: 24.08.2025.

Prepared by:

Norbert DARUKA

Weak Nonlinear Oscillator
COURSE SYLLABUS
Doctoral School on Safety and Security Sciences

Course title: **Weak Nonlinear Oscillator**	Credit value: 6
Course responsible and lecturer (name, academic title): Livia Cvetityanin, Prof.Em.	
Course classification: Basic course (subjects) in the field of safety and security science/ Research topic related basic course / Optional subject	
Proportion of theoretical and practical content, "Training character": …50…% - …50...% theory – practice	
Type of class: lecture / seminar / practice / consultation and total number of classes in the given semester: 30 classes **Methods and (specific) approaches, characteristics used to deliver the course content:** case presentations and case study analyses, project work,	
Form of assessment (exam / practical grade / other): Additional (specific) methods of knowledge assessment:	
Curricular placement of the course (which semester): Can be taken in semesters 1–4	
Prerequisites (if any): none	
Course description: Objective of the course, a concise yet informative description of the knowledge to be acquired	
Objective of the course: To provide students with fundamental knowledge of weak nonlinear oscillator and its applications in engineering systems. **Description of knowledge to be acquired:** Students will acquire - a concise understanding of weak nonlinear vibrations, - analytic solving procedures, - self-excited and damped vibrations, - forced vibrations and resonance, - one- and two degrees of freedom systems, and - examples of application in science and engineering.	
2–5 most important required readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	
- Ivana Kovačić — *Nonlinear Oscillations: Exact Solutions and their Approximations*. Springer, 2020 - Reza N. Jazar — *Perturbation Methods in Science and Engineering*. Springer, 2021.	
2–5 most important recommended readings (textbooks, study materials) with bibliographic data (author, title, publication details, pages, ISBN):	

- M. O. Bilozerova & H. A. Herzhanovs'ka , Asymptotic Behavior of the Solutions of Essentially Nonlinear Nonautonomous Second-Order Differential Equations Close to Linear Functions, Journal of Mathematical Sciences 274, 1-12, 2023.
- Federico Beffa — *Weakly Nonlinear Systems: With Applications in Communications Systems*. Springer, 2024

Date: 17 September 2025

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