Title of the course: Basics of military engineering	**Code: HKDID0010A**	**Credits: 10**
Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training)**: Lecture** 108/36		
Knowledge assessment (exam/academic grade): exam		
The course place in the curricula (in which semester): 1.		
Pre-subject requirements *(if any)*: none		

Course description: The course contains the basic knowledge of the research areas of the doctoral school.

1. Concept of infrastructure and critical infrastructure, the basic principles and vulnerability factors. Critical infrastructure sectors and their management in different countries. The tasks of military engineer support and the principles of their execution. The strategic role of critical infrastructure during wars and NATO's critical infrastructure. Management and guidelines of EU critical infrastructure.
Designation of organizations and elements of critical infrastructure in Hungary and the EU. Professional and cross-sectoral criteria. The concept of resilience and interdependence.
Management of critical infrastructure in Hungary, the procedure for designation and identification. Technical and organizational options for protecting critical infrastructure. Examples from the field of transportation infrastructure.
The concept of military infrastructure, the current status and possible ways of development and its impact on the capabilities of the armed forces. The tasks of property management for properties managed by the Ministry of Defense.
The concept of critical military infrastructure, the characteristics and steps of the designation procedure. Elements within and outside the military sector. Possible technical and other methods of their protection. Impact on the activities of military forces.

2. Design and construction of armoured and automotive equipment. Leopard-2 tank types. Lynx infantry fighting vehicle. Polaris quad. Rába military trucks. Design principles and special construction solutions for air transportable vehicles and combat vehicles. Turbodiesel engines and combat vehicle gas turbines for combat and automotive vehicles. Modern firearms and artillery. The Cz Bren family of weapons. The Carl-Gustaf M4 shoulder-launched, multi-purpose, rear-firing support weapon. Pzh 2000 self-propelled gun. Special artillery of the airborne artillery.
Military robots: unmanned aerial vehicles (UAV) and land robots (UGV). Description of Hungarian UAVs and major foreign types. Methods of take-off and landing of UAVs. Combat, reconnaissance and logistics variants of land robots. Robots in the Hungarian Defence Forces (artillery and hospital).
Military equipment of airborne troops. Descriptions of the aircraft, helicopters and parachutes of parachute deserters, helicopter airborne troops, airborne special operations forces and airborne air transport troops. The main technical tools of disaster management, with particular reference to those used by the Hungarian Defence Forces. Rosenbauer Panther airport fire-fighting truck. Bambi Bucket helicopter fire-fighting system. PTSZ-M tracked floating transport vehicle. KOMONDOR protected vehicle.
Military equipment of the air force. Fighter aircraft, fixed wing aircraft, helicopters and tiltrotor aircraft. The F35 fighter aircraft, stealth, lift-off fan take-off. The JAS-39 Gripen fighter aircraft. The UH-1 helicopter. The Bell-Boeing V-22 Osprey conversion plane (tilt-rotor aircraft).

3. Technical foundations and information infrastructures of the information society. Trends in infocommunication technology.

Civilian and military infocommunication systems. Internet, Mobile cellular systems, satellite navigation systems, Military C4I systems.

Scientific and theoretical interpretation of the information environment and information operations. Technical and cognitive capabilities of information operations NATO's interpretation of information operations.

Interpretation of cyberspace and cyber operations. Offensive and defensive cyber operations. Technical and cognitive tactics, techniques and procedures used in cyber operations, and their effects.

Attacking and protecting networks. Basic attack methods: APT attack, DDoS attack, Phishing, Man-in-the-Middle attack. Basic defense methods: firewalls, antiviruses, access control, intrusion detection/prevention (IDS/IPS).

Interpretation of the electromagnetic environment and electronic warfare. Areas of electronic warfare: electronic support measures, electronic attack (countermeasures), electronic protection.

4. Introduction of the research field of Military Environmental Security, the interpretation of environmental security, its connection to the activities of the armed forces, "Warfare Ecology".

The elements of the environment, the main, primarily technical tasks of environmental protection.

Environmental resources, their scarcity, the characteristics of emerging environmental conflicts, and their correct management.

Environmental harms, their spread, and technical solutions suitable for averting them.

Presentation of some global environmental problems, with special focus on climate change.

Modern, environmentally friendly technical developments and solutions for the armed forces.

5. Interpretation and basics of logistics, Differences between civil and military logistics. Logistics 7M and NATO logistics interpretation.

Force support system. The concept and principles of military logistical support. Military logistics management process.

Sectoral and functional division of military logistics. Tasks of individual support systems and sectors.

Grouping of materials, order of stockpiling. Classification of military equipment

Specifics of military technology, military food and medical support.

The concept, tasks, planning process of Host Nation Suppor. The tasks of RSOM logistics.

6. The concept and interpretation of security; environmental factors defining security

The interpretation of guarding and protection, as well as security technology; aspects of security technology, reliability and safety

Forms of protection and their complex application

The system of tools in integrated physical protection and its complexity

Facility security; integrated security technology systems of facilities

Areas of property security, protection of special facilities.

7. The system of Defence and Security Management, its legal regulatory bases. The content of special legal tasks and the activities of participating organizations.

The comprehensive professional task system of the fire protection, civil protection and industrial safety sectors of disaster management, its organizational elements at the national, regional and local levels.

The legal regulation of fire protection, the tasks of fire prevention. The organization of rescue operations. The system of fire authority inspection activities.

The basic purpose of civil protection. The formation, management and control system and operation of civil protection organizations. The principles and methods of emergency management planning, the protection of the population and material assets.

The system of industrial safety tasks. The safety of dangerous establishments and shipments of dangerous goods, and the resilience tasks of critical organizations.

The tasks and process of chemical accidents response and nuclear accident preparedness.

8. Introduction to the field of research on air transport and aeronautics and its role within the military aviation system. The scientific interpretation of aviation and aeronautical engineering and their interdisciplinary connections, as well as the role of this research area within the development and operational systems of the Hungarian Defence Forces. The fundamental scientific questions of the research field and their relevance to force development programs.

Sustainability and efficiency in military aviation are vital considerations. The main technical factors influencing the efficiency, cost-effectiveness, and environmental sustainability of military aircraft operations are discussed. This includes the feasibility of sustainable aviation within the framework of the Hungarian Defence Forces, as well as the applicability of alternative propulsion systems and renewable energy sources for military use.

Aeronautical regulatory system for aircraft operations. The necessity of an organisational structure to maintain airworthiness, operational and service support systems.

Modern electronic flight instrument systems in aviation: Glass cockpit systems, EFIS (Electronic Flight Instrument System), INS/GNSS/NAV systems, Head-Up Display/Helmet-Mounted Display, Fly-by-Wire systems. Issues of system reliability, redundancy, and protection against interference.

Modern CNS/ATM systems in military aviation. Basic concepts of communication, navigation, and radar technology (CNS). Challenges of integrating military and civilian CNS systems. Interoperability issues within NATO and EU environments.

The evolution and future of drone technology. Contemporary innovations in drone technology, autonomous systems, and artificial intelligence applications. Stakeholders within the drone ecosystem and new types of military operations (e.g., swarm technology, loitering munitions). Technological challenges, defence systems, and future research directions.

9. Flood hazard, flood risk management, flood hazard and risk maps, flood risk management plans

Flood and inland excess water prevention tools and methods

Methods and technologies of flood and inland excess water protection

Differentiated flood control and safety. Increasing of resilience to floods

Flood resilience capacities. The role of the armed forces and law enforcement in flood and inland excess water management

Flash floods, local water damage and its management

Required readings:

1. Robert S. Radvanovsky – Allan McDougall: *Critical Infrastructure: Homeland Security and Emergency Preparedness*. CRC Press, 2019. ISBN 9781138057791
2. Szirota Anita – Molnár Péter – Sebők István – Hegedűs Ernő: The 84 mm recoilless support weapon system in the armament arsenal of the Hungarian Defence Forces. *Haditechnika* 2020/54, 2-7.
3. a. *FM 3-12 Cyberspace Operations and Electromagnetic Warfare.* Department of the Army, August 2021. URL: https://irp.fas.org/doddir/army/fm3-12.pdf
   b. *ADP 3-13 Information*. Department of the Army, November 2023. URL: https://irp.fas.org/doddir/army/adp3-13.pdf
4. Rita Floyd – Richard A. Matthew (eds.): *Environmental Security – Approaches and issues.* Abingdon Press, 2015. ISBN 9780415538992 ISBN 9780415539005 ISBN 9780203108635
5. Jeremy Smith (ed.): *Defence logistics: enabling and sustaining successful military operations.* Kogan Page Publishers, 2018. ISBN 9780749478032
6. Vidrikova – Boc – Dvořák – Řehák: *Critical infrastructure and integrated protection (Vol. 1)*. Association of Fire and Safety Engineering, Ostrava, 2017.
7. Kátai-Urbán, Lajos: *Handbook for the Implementation of the Basic Tasks of the Hungarian Regulation on „Industrial Safety"*. Budapest, Nemzeti Közszolgálati Egyetem, 2014.
8. Brij N. Agrawal – Max F. Platzer: *Standard Handbook for Aerospace Engineers*. Second Edition. McGraw Hill, 2018. ISBN 9781259585180
9. Paul B. Sayers (ed.): *Flood Risk: Planning, Design and Management of Flood Defence Infrastructure*. ICE Publishing, UK, 2012. ISBN 9780727741561

Responsible for course (name, position, scientific degree):
Maj. Gen. (Ret.) Dr. József PADÁNYI, full professor, PhD, DSc

Teachers (name, position, scientific degree):

1. Col. (Ret.) Dr. Ferenc KOVÁCS, PhD
2. Lt. Col. Dr. Ernő Hegedűs, PhD
3. Maj. Gen. Dr. László KOVÁCS, PhD, DSc; Col. Dr. Zsolt HAIG, PhD
4. Col. Dr. László FÖLDI, PhD
5. Lt. Col. Dr. Attila DERZSÉNYI, PhD
6. Col. Dr. Tamás BEREK, PhD
7. C.D. Maj. Gen. (Ret.) Dr. Muhoray Árpád, PhD; F.F. Col. Dr. Lajos KÁTAI-URBÁN, PhD
8. Col. Dr. László KAVAS, PhD; Lt. Col. Dr. Bertold BÉKÉSI, PhD; Cpt. Dr. Krisztián KÁROLY, PhD
9. Dr. Tibor BÍRÓ, PhD; Dr. Péter KOZÁK, PhD; Dr. Gábor KEVE, PhD; Maj. Gen. (Ret.) Dr. József PADÁNYI, PhD, DSc

Title of the course: Theory and methodology of scientific research	**Code: HKDID0011A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): 1.

Pre-subject requirements *(if any)*: none

Course description:
The meaning of PhD, the requirements of obtaining a doctorate, the doctoral training. The research profile of the Doctoral School of Military Engineering. Publication possibilities. The attitude of a researcher. Research plan, time plannig. Research topic, supervisor, research group, scholarship, cooperation. Hypothesis, goal, thesis. Scientific literature, sources. References. Gray literature. Terminology. Searching on the internet, AI. Formal requirements of a publication. Rules of refences. Secondary sources. Questionnaire, sampling, representativity. Interview. Case study. Experiments. Systematic and statistical error. Simulations. Visualization. Style, argumentation, critics, argumentation failures. Ethical questions, plagiarism. The formal requirements and contents of the doctoral dissertation.

Educational goal of subject - Competencies:
The aim of the subject is to form and develop the necessary skills in the students for the self-sufficient research work, and to get them acquainted the key elements of the research process. We urge the student to self-sufficient research during the course.

Required readings:
1. ECO, Umberto: How to write a thesis. Cambridge (MA): The MIT Press, 2015., ISBN 9780262527132

Responsible for course (name, position, scientific degree): Maj. Gen. Dr. József Padányi, full professor

Title of the course: Processing and publication of research data	**Code: HKDID0309A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 6/2 hours / Seminar: 4/2 hours / Consultation: 10/2 hours

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): 2. semester is recommended (depends on the individual educational program)

Pre-subject requirements *(if any)*: none, but it is recommended to successfully fulfill the requirements of the theory and practice of scientific research.

Course description:
The aim of the course is to broaden the theoretical and practical framework of the subject "Theory and Practice of Scientific Research", which was already acquired and acquired, primarily - on a practical level. To this end, students will become familiar with the open and paid software used in military engineering, military and broader social science research, major statistical methods and applications, and the collection, management, processing and evaluation of primary data. The course focuses not only on teaching statistical formulas, but on understanding and practicing statistical terms / methods with the aim of promoting the professional-scientific career of students in military science and military technical schools.

Educational goal of subject - Competencies:
The goal is for students to be able to design, implement and evaluate the results obtained based on their theoretical knowledge and to write an independent study.

Required readings:

1. C.R. Kothari (2004): *Research Methodology. Methods and Techniques.* New Age International, New Delhi. 401 p. ISBN: 978-81-224-2488-1
2. Conrad Carlberg (2011): *Statistical Analysis.* Que Publishing, Indiana. 464 p. ISBN: 978-0-7897-4720-4
3. E. Joseph Billo (2007): *Excel for Scientists and Engineers.* Numerical Methods. Wiley & Sons, Hoboken. 454 p. ISBN: 978-0-47 1-38734-3

Recommended readings:

1. PSPP Users' Guide. https://www.gnu.org/software/pspp/manual/pspp.pdf

Responsible for course (name, position, scientific degree): Dr. Kollár Csaba PhD senior research fellow

Title of the course: Basics of the process of the PhD procedure	**Code: HKDID0012A**	**Credits: 0**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 6/6 hours

Knowledge assessment (exam/academic grade): signature

The course place in the curricula (in which semester): 8.

Pre-subject requirements *(if any)*: none

Course description:

The rules of presenting scientific results in writing. The rules of presenting scientific results orally; presentation, debate. Rules of formulating the hypotheses, goals and theses. The formal requirements and the contents of a doctoral dissertation, the process of the writing. Cooperation with the supervisor. Ethical questions. The administraive process of the doctoral procedure. The home defense. The doctoral defense.

Educational goal of subject - Competencies:

Knows the steps of the doctoral process and its requirements. Able to present their scientific results in an adequate way both in writing and orally. Knows the ethical requirements of the doctoral procedure.

Required readings:

How to structure a dissertation? https://www.scribbr.com/category/dissertation/

Responsible for course (name, position, scientific degree): Dr. Bence TÓTH, Habil. Reader

Title of the course: PhD Research - Methodology of Military Engineering	**Code: HKDID0319A**	**Credits: 2**

Where is the education: NUPS Doctoral School of Military Engineering

Type of lessons and learning hours (full-time training/part-time training): 20/6 hours

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): II-IV. semester

Pre-subject requirements *(if any)*: none

Course description:
The aim of the course is to learn and develop creative research methodological concept related to the military engineering challenges of our age. This course familiarises the students with the theoretical and practical issues of Military Engineering, provide details on expertise of Research + Development + LifeCycle Logistics Support (R&D + LCLS) planing, organisation and implementation, as well as the course explains the factors, the procedures and methods that make military research difficult and risky.

Knowledge, theme structure:

1. The concept, place, role and specialties of military engineering knowledge, its relation to tactical expectations. Criterias for the effectiveness of R&D & LCLS.
2. The main stages in the history of the development of the military engineering vision. Expectations and requirements of modeling and experiment concept, steps, and its implementation rules.
3. The impact and possibilities of Artificial Intelligence, cognitive decision support systems on data collection, data analysis objectives and Military-Engineering-Requirement ("Statement of Work") change risk analysis.
4. Significance, organization and evaluation of military equipment/system tests, examinations and "in-situ" performance measurements.
5. The issues of individual and cooperation (domestic + international) works during R&D & LCLS.

Educational goal of subject - Competencies:
The student will be able to design and run military technical research, formulate research objectives, define methods and collect targeted materials. They get a comprehensive picture of the history of military research technology, its main milestones and peculiarities. They will be familiar with decision-making problems and ways of using collected results constructively.
High level of knowledge: > 80%; Proficiency: > 65%; Ability: > 51%.

Requirements:
There are two conditions for completing the semester:

1. During the semester, a mid-term assignment shall be completed, which qualification is based on a five-level assessment. Their detailed requirements, deadlines for completion and replacement are determined during the first session.
2. The teoretical knowledge must be shown in writen short exam at the end of the semester.

The condition for signing is also the attendance in a minimum of 75% of the clsasses in case of full-time training, 50% of the classes in correspondence training, and at least a

sufficient level of assessment of the mid-term assignment and writen short exam. The results can be improved once during the diligence period.

Quality assurance methods:
Providing regular consultation opportunities, welcoming and incorporating student opinions and feedback into the educational process where possible. Continuous monitoring of new scientific results and methods related to the subject by studying the Hungarian and international literature and then incorporating them into the curriculum.

Required readings:

1. Sun Tzu: The Art of War, https://suntzusaid.com/
2. István, Balajti: Performance Measurements of the Radar "In Situ", In: IEEE (szerk.) Microwaves, Radar and Remote Sensing Symposium, 2008. MRRS 2008,Kiev,: Institute of Electrical and Electronics Engineers (IEEE), (2009) pp. 334-339.
3. Balajti, István ; Hajdú, Ferenc: Surprising Findings from the Hungarian Radar Developments in the Era of the Second World War, RADIO SCIENCE BULLETIN 358 : September pp. 82-108. , 27 p. (2016)

Recommended readings:

4. Carl von CLAUSEWITZ: On War, Amazon, ISBN-10: 0691018545
5. How to Write a Synthesis Essay; https://www.wikihow.com/Write-a-Synthesis-Essay
6. Decision Model: https://www.decision-making-solutions.com/decision_making_model.html
7. MathWorks: Teach with MATLAB and Simulink, „Provide hands-on learning experiences to analyze data, create models and simulate" systems. https://nl.mathworks.com/academia/educators.html?s_v1=30930&elqem=3065604_EM_ROW_DIR_20-04_NEWSLETTER_COVID-EDU-ENG&elqTrackId=adf3137f9cd8432a9d52a3681c074df5&elq=da7c0e9a01e24920b2fd60d3f027fbaa&elqaid=30930&elqat=1&elqCampaignId=11198 (Letöltés : 2020.04.25)

Responsible for course (name, position, scientific degree): Dr. Habil.István Balajti, CSc

Other teachers (name, position, scientific degree): none

Title of the course: Efficient mathematical methods in military technical sciences	**Code: HKDID0331A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **30/10**

Knowledge assessment (exam/academic grade):**exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: --

Course description: Applied linear algebra. Soft computing methods. Fuzzy logic. Theory of neural networks. Global optimization, genetic algorithms. Probability theory. Modelling using random numbers, Monte-Carlo methods. Time-series forecasting. Theory of differential equation systems. Numerical methods. Queuing theory.

Educational goal of subject - **Competencies:** Students would be able modelling, examining and analysing technical problems that arise in military technical sciences using modern and efficient mathematical tools. Be able to characterize, draw up scientific results and conclusions in numerical form using efficient tools of modern mathematics. Be able to come conclusions, inferencing, making mathematical models, solving optimization problems, making predictions, analysing and assessing risks.

Required readings: Strang: Introduction to linear algebra
Wellesley-Cambridge press, MA, 2003, ISBN 0-9614088-9-8

Recommended readings: Hillier-Lieberman: Intoduction to operations research
McGraw-Hill, 2001, ISBN 0-07-232169-5
Jager: Fuzzy logic in control
Technische Universiteit Delft, 2005, ISBN 90-9008318-9

Responsible for course (name, position, scientific degree): Dr. László HANKA PhD

Other teachers (name, position, scientific degree): --

Title of the course: Application of tools of mathematical statistics for data processing	**Code: HKDID0332A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **30/10**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: --

Course description: Application of the methods of mathematical statistics for data analysis and data processing. Estimation theory, point and interval estimation, confidence intervals. Hypothesis testing. Statistical tests. One- and two-sample tests, parametric and non-parametric tests. Analysis of variance. Goodness of fit tests. Correlation and regression analysis.

Educational goal of subject - **Competencies:** Students would be able to characterize single or multiple data series by numerical data using tools and language of mathematical statistics. Be able to analyse relation between data series, to come to numerical conclusions, inferencing. Be able to make probabilistic, statistical estimations, making risk assessment using numerical data. Making predictions, forecasting.

Required readings: Feller: An introduction to probability theory and its applications. John Wiley @ Sons, NY. 1970

Recommended readings: Roussas: A course in mathematical statistics
London, Academic press, 1998, ISBN 0-12-599315-3
Karlin – Taylor: Introduction to stochastic processes.
London, Academic press, 1998, ISBN 0-12-684887-4

Responsible for course (name, position, scientific degree): Dr. László HANKA PhD

Other teachers (name, position, scientific degree): --

Title of the course: Fundamentals of Military Operations	**Code: HKDID0333A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 20/6

Knowledge assessment (exam/academic grade): **academic grade**

The course place in the curricula (in which semester): 2

Pre-subject requirements *(if any)*: -

Course description:

Within the framework of the course, students will become familiar with the foundations of operational theory, including the concept and importance of operational-level warfare, the process of operational planning, the determination of operational capabilities and limitations, the theory of operational application forms, and the phases of troop employment. During the study of surface, particularly land operations, students will learn the principles of the operational application of land forces, the role of movement, fire, and maneuver in operations, as well as the characteristics of defensive and offensive operations. The role of the air force in operational-level warfare will be addressed through air operations, with particular attention to air strikes, the use of precision strike weapons, and air and missile defense. In the topic of joint operations, students will gain insight into the practice of joint planning and leadership, the operation of integrated forces and operational systems, and the methods of combined fire and maneuver.

Educational goal of subject - Competencies:

The aim of the course is to present the theoretical and practical foundations of military operations, taking into account the key elements of operational art, military science, and doctrinal approaches. Students will acquire an operational mindset that enables them to interpret and apply modern operational doctrines. They will be capable of analyzing and interpreting the complex processes of military operations, as well as the environmental and technological conditions that influence warfare.

Required readings:

1. Milan Vego: Joint Operational Warfare: Theory and Practice, Naval War College, 2009.
2. NATO AJP-3: Allied Joint Doctrine for the Conduct of Operations
3. NATO AJP-3.3: Allied Joint Doctrine for Air and Space Operations

Recommended readings:

1. FM 3-0 Operations, U.S. Army Doctrine, 2022.
2. McMaster, H.R.: Battlegrounds: The Fight to Defend the Free World, Harper, 2020.

Responsible for course (name, position, scientific degree): Colonel Dr Zoltán Krajnc, University Professor, PhD (Military Sciences)

Other teachers (name, position, scientific degree): Major Dr János Csengeri, Associate Professor PhD (Military Sciences), Lieutenant Colonel Ferenc Fazekas, Lieutenant Colonel Dr Sándor Szabó, Assistant Professor, PhD (Military Sciences)

Title of the course: Implementation of the FP tasks' new technical equipments and principles, opportunities of application of those	**Code: HKDID1103A**	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **Lecture 30/10 hours / Consultation 30/10 hours**

Knowledge assessment (exam/academic grade): **Comprehensive exam**

The course place in the curricula (in which semester): from the 2nd semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: This course is based on the common consolidated mods exam of subjects of two PhD schools (The Basics of Scientific Work and the Military Technical Knowledge I.) and on the common exam subject of the Military Engineering PhD School (the Military Technical Knowledge II.).

Course description:

Our goal is to familiarize the new equipment and their new practices of the Force Protection to the PhD students. In the course of it, we present the novel, the enhancing of survivability's regulations, their technical equipment, its grouping and principles of these.

The course covers the planning, organizing and implementing of FP tasks, both in war and non-war operations as well. The course details the theoretical and practical aspects of the development, upgrading of FP tasks too.

Educational goal of subject - **Competencies:**

During the course the PhD students could obtain the following competencies:

- analytical skills;
- application of theoretical knowledge;
- system approach;
- planning and organizing skills;
- thinking of alternatives.

Required readings:

1. STANAG 2394 Engr (Ed2) Land Force Combat Engineer Doctrine
2. Joint Forward Operations Base (JFOB) Force Protection Handbook. A publication of the Joint Staff J3 Deputy Directorate for Antiterrorism/Homeland Defense Antiterrorism/Force Protection Division. Second printing 2006.
3. Joint Contingency Operations Base (JCOB) Force Protection Handbook (GTA 90-01-010). A publication of the Joint Staff J3 Deputy Directorate for Antiterrorism/Homeland Defense Antiterrorism/Force Protection Division. October 2007.

Recommended readings:

1. "Force Protection key to Army XXI plan" – http://www.dtic.mil/armylink/news

2. Force Protection: antiterrorism, 1997. US Army Training and Doctrine Command- http://ftp.fas.org/irp/doddir/army
3. USFK 525-13: USFK Force Protection Program

Responsible for course (name, position, scientific degree): Dr. Zoltán KOVÁCS (PhD)

Other teachers (name, position, scientific degree): -

Title of the course: Physical protection of military critical infrastructures	**Code: HKDID1106A**	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **Lecture 30/10 hours, Consultation 30/10**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): from 2nd semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

Concept of military critical infrastructure, its items and features. Threats to military critical infrastructure. Sectorial requirements, tasks of administrative agencies and military organizations. Possibilities, methods of protecting military critical infrastructure and equipment of physical protection.

Educational goal of subject - Competencies:
To give a general overview about the different blasting equipment and technologies. PhD students may obtain the following competencies:

- analytical skills;
- application of theoretical knowledge;
- system approach;
- planning and organizing skills;
- thinking of alternatives.

Required readings:

1. STANAG 2280 Design Threat Levels And Handover Procedures For Temporary Protective Structures, MCLSB, 2008.
2. Commission of the European Communities: Green Paper on a European Programme for Critical Infrastructure Protection, Brussels, 17.11.2005 COM(2005) 576 final
3. NATO Parlamentary Assembly: 162 CDS 07 E rev 1 - The Protection Of Critical Infrastructures, http://www.nato-pa.int/Default.asp?SHORTCUT=1165
4. The Department of Defense Critical Infrastructure Protection (CIP) Plan, http://fas.org/irp/offdocs/pdd/DOD-CIP-Plan.htm
5. UFC 4-010-01 9 February 2012 Unified Facilities Criteria (UFC) DoD Minimum Antiterrorism Standards for Buildings, http://www.wbdg.org/ccb/DOD/UFC/ufc_4_010_01.pdf
6. MC 472 NATO Military Concept for Defence Against Terrorism 2002. december

Recommended readings:

1. Center For Infrastructure Engineering Studies: Blast Resistance of Un-reinforced Masonry Walls Retrofitted with Fiber Reinforced Polymers, Department of Civil Engineering University of Missouri – Rolla, 2002.

2. Kovács Zoltán: Multifunctional engineer barriers., In: Semságné Kádár Márta (szerk.) New challenges in the field of military sciences 2007: International Scientific Conference : proceedings : 2. Electrical engineering and aviation. 146 p. , Budapest: Zrínyi Miklós Nemzetvédelmi Egyetem, 2007. pp. 1-5. (ISBN: 978-963-87706-0-8)
3. Szabó Sándor, Kovács Zoltán, Tóth Rudolf: Force protection solutions with HESCO Bastion Concertainer., Academic And Applied Research In Military Science 10:(1) pp. 31-59. (2011)
4. HARBER David: THE ANARCHIST ARSENAL, Improvised Incendiary and Explosives Techniques; Paladin Press Boulder, Colorado 1990. ISBN 0-87364-580-4; p. 112.

Responsible for course (name, position, scientific degree): Dr. Zoltán KOVÁCS associate professor, PhD

Other teachers (name, position, scientific degree):

Title of the course: Blasting tasks and technics	**Code: HKDID1211A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **Lecture 30/10 hours**

Knowledge assessment (exam/academic grade): **Final exam**

The course place in the curricula (in which semester): 2nd – 4th semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
The course of blast. General characteristics of explosives. Military and civilian explosives. Ignition of explosives. Shaped charges. Military blasting tasks and techniques. Planning, organizing and executing blasting tasks.

Educational goal of subject - Competencies:
To give a general overview about the different blasting equipment and technologies. PhD students may obtain the following competencies:

- analytical skills;
- application of theoretical knowledge;
- system approach;
- planning and organizing skills;
- thinking of alternatives.

Required readings:

1. STANAG 2394 Engr (Ed2) Land Force Combat Engineer Doctrine (2011)
2. VALTERS, William: A Brief History of Shaped Charges, 24th International Symposium on Ballistics, vol. 1, pp. 3–10, New Orleans, LA, 22–26 September 2008.
3. TM 9-1300-214 Military explosives technical Manual, Headquarters, Department of the Army, Washington DC, USA, 1984.
4. KÖHLER, J. – MEYER, R.: Explosives – Fourth, revised and extended edition, VCH Verlagsgesellschaft mbH, Wenheim, Federal Republic of Germany, 1993.

Recommended readings:

1. Flood- and ice-prevention with explosives. Bolyai Szemle Különszám: Symposium Proceedings "Defence Technology VIIth International Symposium" CD-ROM. Zrínyi Miklós Nemzetvédelmi Egyetem Bolyai János Katonai Műszaki Főiskolai Kar, pp. 1-8.
2. Using explosives and landmines for coutermobility tasks. Proceedings of the International Conference on Military Technologies 2009., University of Defense, Brno, 2009. pp. 149-159. (ISBN:978-80-7231-649-6)
3. HARBER David: THE ANARCHIST ARSENAL, Improvised Incendiary and Explosives Techniques; Paladin Press Boulder, Colorado 1990. ISBN 0-87364-580-4; p. 112.

Responsible for course (name, position, scientific degree): Dr. Zoltán KOVÁCS associate professor, PhD

Other teachers (name, position, scientific degree):

Title of the course: IED & VBIED survey and neutralization	**Code: HKDID1214A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **Lecture 30/10**

Knowledge assessment (exam/academic grade): **Final exam**

The course place in the curricula (in which semester): 2nd – 4th semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Improvised explosive devices. Main parts and characteristics os IED. Vehicle born improvised explosives devices. Tasks, equipment of IED & VBIED survey. Protective measures to defeat (improvised) explosive devices.

Educational goal of subject - Competencies:

To give a general overview about the IED & VBIED assets, possible protective and defensive measures. PhD students may obtain the following competencies:

- analytical skills;
- application of theoretical knowledge;
- system approach;
- planning and organizing skills;
- thinking of alternatives.

Required readings:

1. Kovács Zoltán, Daruka Norbert: IEDD: Improvised Explosive Device Disposal. International Conference in Military Technology Proceeding: ICMT'13, Brno: University of Defence, 2013. pp. 383-390. (ISBN:978-80-7231-917-6)
2. Counter-IED Smart Book Version 2.1, For Pre-deployment and Field Use; Kwikpoint; ISBN KP-MIL-GEN-FB01; p. 300.
3. Counter-IED Smart Guide, Visual Recognition of IED and HME Indicators; Kwikpoint; ISBN KP-MIL-GEN-FB04; p. 80.
4. Dismounted C–IED Smart-Book, Version 1.0 Dated 08 Nov. 2011, Joint IED Defeat Organization (JIEDDO) Joint Center of Excellence (JCOE)
5. IED SMART BOOK, 1st Edition CEXC-Afghanistan Combined Explosives Exploitacion Cell Current as of: 13 Sep. 2006.

Recommended readings:

1. JIEDDO – Joint Improvised Explosive Device Defeat Organization 2006, No.: 20110504-V1.
2. Afghan Counter IED Visual Awareness Guide, Visual Recognition of IED and HME Indikators; Kwikpoint ISBN K21-MIL-AF45
3. GONZALES Jo Jo: Death by Deception, Advanced Improvised Booby Traps; Paladin Press, Boulder Colorado. ISBN 0-87364-651-7; p.120.

4. HARBER David: THE ANARCHIST ARSENAL, Improvised Incendiary and Explosives Techniques; Paladin Press Boulder, Colorado 1990. ISBN 0-87364-580-4; p. 112.
5. KÖHLER, J. – MEYER, R.: Explosives – Fourth, revised and extended edition, VCH Verlagsgesellschaft mbH, Wenheim, Federal Republic of Germany, 1993.

Responsible for course (name, position, scientific degree): Dr. Zoltán KOVÁCS associate professor, PhD

Other teachers (name, position, scientific degree):

Title of the course: New tools for technical support of peace support operations.	**Code: HKDID1216A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **Lecture 30/10 hours**

Knowledge assessment (exam/academic grade): **Final exam**

The course place in the curricula (in which semester): in the 2nd – 4th semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: -

Course description:

With systematic, analytical skills we help those PhD students, who have chosen research areas from the military technical sciences. The course covers the tasks of peace support operations, the concept, goal and main tasks of engineer support of peacekeeping operations. This course gives an overview about the all tasks of engineer support of peace support operations.

Educational goal of subject - Competencies:

During the course the PhD students could obtain the following competencies:

- analytical skills;
- application of theoretical knowledge;
- system approach;
- planning and organizing skills;
- thinking of alternatives.

Required readings:

4. STANAG 2394 Engr (Ed2) Doctrine for Military Engineering
5. JP 3-34 Engineer Doctrine for Joint Operationts (2011)
6. ATP 300-34.40 General Engineering February 2015.

Recommended readings:

4. "Force Protection keyto Army XXI plan" – http://www.dtic.mil/armylink/news
5. Joint Tacticts, Techniques and Procedures 4-05, Operational Infrastructure - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/73187/jttp4_05_Op_Infra_Ed2.pdf
6. USFK 525-13: USFK Force Protection Program

Responsible for course (name, position, scientific degree): Dr. Zoltán KOVÁCS (PhD)

Other teachers (name, position, scientific degree): -

Title of the course: Physical protection of military critical infrastructures	**Code: HKDID1217A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **Lecture 30/10 hours**

Knowledge assessment (exam/academic grade): **Final exam**

The course place in the curricula (in which semester): 2nd – 4th semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

Concept of military critical infrastructure, its items and features. Threats to military critical infrastructure. Sectorial requirements, tasks of administrative agencies and military organizations. Possibilities, methods and equipment of protecting military critical infrastructure.

Educational goal of subject - Competencies:
To give a general overview about the different blasting equipment and technologies. PhD students may obtain the following competencies:

- analytical skills;
- application of theoretical knowledge;
- system approach;
- planning and organizing skills;
- thinking of alternatives.

Required readings:

1. STANAG 2280 Design Threat Levels And Handover Procedures For Temporary Protective Structures, MCLSB, 2008.
2. Commission of the European Communities: Green Paper on a European Programme for Critical Infrastructure Protection, Brussels, 17.11.2005 COM(2005) 576 final
3. NATO Parlamentary Assembly: 162 CDS 07 E rev 1 - The Protection Of Critical Infrastructures, http://www.nato-pa.int/Default.asp?SHORTCUT=1165
4. The Department of Defense Critical Infrastructure Protection (CIP) Plan, http://fas.org/irp/offdocs/pdd/DOD-CIP-Plan.htm
5. UFC 4-010-01 9 February 2012 Unified Facilities Criteria (UFC) DoD Minimum Antiterrorism Standards for Buildings, http://www.wbdg.org/ccb/DOD/UFC/ufc_4_010_01.pdf
6. MC 472 NATO Military Concept for Defence Against Terrorism 2002. december

Recommended readings:

1. Center For Infrastructure Engineering Studies: Blast Resistance of Un-reinforced Masonry Walls Retrofitted with Fiber Reinforced Polymers, Department of Civil Engineering University of Missouri – Rolla, 2002.

2. Kovács Zoltán: Multifunctional engineer barriers., In: Semságné Kádár Márta (szerk.) New challenges in the field of military sciences 2007: International Scientific Conference : proceedings : 2. Electrical engineering and aviation. 146 p. , Budapest: Zrínyi Miklós Nemzetvédelmi Egyetem, 2007. pp. 1-5. (ISBN: 978-963-87706-0-8)
3. Szabó Sándor, Kovács Zoltán, Tóth Rudolf: Force protection solutions with HESCO Bastion Concertainer., Academic And Applied Research In Military Science 10:(1) pp. 31-59. (2011)
4. HARBER David: THE ANARCHIST ARSENAL, Improvised Incendiary and Explosives Techniques; Paladin Press Boulder, Colorado 1990. ISBN 0-87364-580-4; p. 112.

Responsible for course (name, position, scientific degree): Dr. Zoltán KOVÁCS associate professor, PhD

Other teachers (name, position, scientific degree):

Title of the course: Blasting tasks and technics for iceflood protection	**Code: HKDID1412A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **Lecture 14/4 hours / Consultation: 6/2**

Knowledge assessment (exam/academic grade): **Academic grade**

The course place in the curricula (in which semester): from 2nd – 4th semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Technical assets of iceflood protection. Blasting techniques. Equipment of flood prevention organizations. Cooperation between civilian and military demolition groups.

Educational goal of subject - Competencies:
To give a general overview about the flood protection blasting tasks. PhD students may obtain the following competencies:

- analytical skills;
- application of theoretical knowledge;
- system approach;
- planning and organizing skills;
- thinking of alternatives.

Required readings:

1. STANAG 2394 Engr (Ed2) Land Force Combat Engineer Doctrine (2011)
2. Flood- and ice-prevention with explosives. Bolyai Szemle Különszám: Symposium Proceedings "Defence Technology VIIth International Symposium" CD-ROM. Zrínyi Miklós Nemzetvédelmi Egyetem Bolyai János Katonai Műszaki Főiskolai Kar, pp. 1-8.
3. TM 9-1300-214 Military explosives technical Manual, Headquarters, Department of the Army, Washington DC, USA, 1984.
4. KÖHLER, J. – MEYER, R.: Explosives – Fourth, revised and extended edition, VCH Verlagsgesellschaft mbH, Wenheim, Federal Republic of Germany, 1993.

Recommended readings:

1. JP 3-34 Engineer Doctrine for Joint Operationts (2011)
2. VALTERS, William: A Brief History of Shaped Charges, 24th International Symposium on Ballistics, vol. 1, pp. 3–10, New Orleans, LA, 22–26 September 2008.

Responsible for course (name, position, scientific degree): Dr. Zoltán KOVÁCS, associate professor, PhD

Other teachers (name, position, scientific degree):

Title of the course: Environmental aspects of military blasting tasks	**Code: HKDID1414A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 14/4 hours / Seminar: 4/1 hours / Consultation: 2/1

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): from 2nd – 4th semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Basic information about course of blast. Characteristics of blasting and its effect on environment. Charges and their characteristics. Environmental aspects of military blasting and demolition tasks. Technical and technological solutions to decrease damage to the environment.

Educational goal of subject - Competencies:
To give a general overview about the environmental aspects of balsting tasks. PhD students may obtain the following competencies:

- analytical skills;
- application of theoretical knowledge;
- system approach;
- planning and organizing skills;
- thinking of alternatives.

Required readings:

1. STANAG 2394 Engr (Ed2) Land Force Combat Engineer Doctrine (2011)
2. Flood- and ice-prevention with explosives. Bolyai Szemle Különszám: Symposium Proceedings "Defence Technology VIIth International Symposium" CD-ROM. ZMNE BJKMK, pp. 1-8.
3. TM 9-1300-214 Military explosives technical Manual, Headquarters, Department of the Army, Washington DC, USA, 1984.
4. KÖHLER, J. – MEYER, R.: Explosives – Fourth, revised and extended edition, VCH Verlagsgesellschaft mbH, Wenheim, Federal Republic of Germany, 1993.

Recommended readings:

1. Using explosives and landmines for coutermobility tasks. Proceedings of the International Conference on Military Technologies 2009., University of Defense, Brno, 2009. pp. 149-159. (ISBN:978-80-7231-649-6)
2. HARBER David: IMPROVISED LAND MINES, Their Employment and Destructive Capabilities; Paladin Press Book, Colorado, ISBN 0-87364-656-8; p. 88.
3. HARBER David: THE ANARCHIST ARSENAL, Improvised Incendiary and Explosives Techniques; Paladin Press Boulder, Colorado 1990. ISBN 0-87364-580-4; p. 112.

4. VALTERS, William: A Brief History of Shaped Charges, 24th International Symposium on Ballistics, vol. 1, pp. 3–10, New Orleans, LA, 22–26 September 2008.

Responsible for course (name, position, scientific degree): Dr. Zoltán KOVÁCS, associate professor, PhD.

Other teachers (name, position, scientific degree):

Title of the course: Theory, methodology and NATO aspects of R&D in military technology	**Code: HKDID2103A**	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture, 60 hours (full time training, Lecture, 20 hours (part time training).

Knowledge assessment (exam/academic grade): exam

The course place int he curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any):* *not any*

Course description:

Logistics, research and development (R&D). Standardization, quality assurance, contracting, trials and testing. Theory and methodology of research and development in military technology. Basics, phases and practice of military R&D. Participants of R&D and their tasks. Cutting edge technologies. NATO Science and Technology Organization. Life cycle, milestones. Phased Armaments Programming System (PAPS). Hungarian Defense Industry. Multicriteria Decision Making. Árpád artillery fire control system. Árpád comparison to other artillery systems. NATO quality assurance. Internet research methods. Military technology databases (Jane's, Proquest Military). Military journals. Technology forecast. NATO Science and Technology Strategy.

Educational goal of subject – Competencies:

PhD students get familiar with basics and details of defense industry, research, development and technology methodologies and practices.

Required readings:

- Gyarmati József, Felházi Sándor, Kende György: Choosing the Optimal Mortar for an Infantry Battalion's Mortar Battery with Analytic Hierarchy Process using Multivariate Statistics. Brussels, 2009, Royal Military Academy. Conference on Decision Support Methodologies for Acquisition of Military Equipment. ISBN 978-92-837-0101-9. RTO-MP-SAS-080. URL: http://www.rta.nato.int/Pubs/RDP.asp?RDP=RTO-MP-SAS-080
- Gyarmati József, Dr. Kende György, Rózsás Tamás, Dr. Turcsányi Károly: The Hungarian field artillery fire control system ARPAD and its comparison with other systems. *AARMS (Academic and Applied Research in Military Science), 2002. Volume 1 Issue 1. 9-38.pp.* http://www.zmne.hu/aarms/index.htm
- Hangya Gábor, Kende György: Modern methods of research and analysis in military technology. *AARMS (Academic and Applied Research in Military Science), 2004. Volume 3 Issue 3. 459-472.pp.* http://www.zmne.hu/aarms/index.htm

Recommended readings:

- NATO Standardization Agreements http://www.nato.int/docu/standard.htm
- The NATO Science & Technology Organisation homepage http://www.sto.nato.int
- NATO Logistics Handbook http://www.nato.int/docu/logi-en/logist97.htm

Responsible for course (name, position, scientific degree): Prof. Dr. György Kende, colonel retired, DSc

Other teachers (name, position, scientific degree): -

Title of the course: **Past, present and future of the Hungarian R&D in military technology**	**Code: HKDID2204A**	**Credits:** 3

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture, 30 hours, (full time training) Lecture, 10 hours,(part time training).

Knowledge assessment (exam/academic grade): exam

The course place int he curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any):* *not any*

Course description:
Logistics, research and development (R&D). Standardization, quality assurance, contracting, trials and testing. Theory and methodology of research and development in military technology. Basics, phases and practice of military R&D. Participants of R&D and their tasks. Cutting edge technologies. Hungarian Defense Industry. Multicriteria Decision Making. Árpád artillery fire control system. Árpád comparison to other artillery systems. Internet research methods. Military technology databases (Jane's, Proquest Military). Military journals. Visiting a Hungarian industrial base.

Educational goal of subject – Competencies:

PhD students get familiar with basics and details of Hungarian defense industry, research, development and technology methodologies and practices.

Required readings:

- Defense Industry Association of Hungary. Homepage. http://www.vedelmiipar.hu/?module=showpage&site=welcome&group=&menupath=&product=&lang=eng Downloaded 16 April 2016
- Gyarmati József, Felházi Sándor, Kende György: Choosing the Optimal Mortar for an Infantry Battalion's Mortar Battery with Analytic Hierarchy Process using Multivariate Statistics. Brussels, 2009, Royal Military Academy. Conference on Decision Support Methodologies for Acquisition of Military Equipment. ISBN 978-92-837-0101-9. RTO-MP-SAS-080. URL: http://www.rta.nato.int/Pubs/RDP.asp?RDP=RTO-MP-SAS-080
- Gyarmati József, Dr. Kende György, Rózsás Tamás, Dr. Turcsányi Károly: The Hungarian field artillery fire control system ARPAD and its comparison with other systems. *AARMS (Academic and Applied Research in Military Science), 2002. Volume 1 Issue 1. 9-38.pp.* http://www.zmne.hu/aarms/index.htm

Recommended readings:

- NATO Logistics Handbook http://www.nato.int/docu/logi-en/logist97.htm
- Hangya Gábor, Kende György: Modern methods of research and analysis in military technology. *AARMS (Academic and Applied Research in Military Science), 2004. Volume 3 Issue 3. 459-472.pp.* http://www.zmne.hu/aarms/index.htm
- Jane's

Responsible for course (name, position, scientific degree): Prof. Dr. György Kende, colonel retired, DSc

Other teachers (name, position, scientific degree): -

Title of the course: Effects of a generational modernization in the HDF on Force Readiness	**Code HKDID2233A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture, 30 hours, (full time training) Lecture, 10 hours,(part time training).

Knowledge assessment (exam/academic grade): exam

The course place int he curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any):* *not any*

Course description: History of warfare has undergone several paradigm changes. Causes and conditions of a generational technological modernization on the national and international industry base. Effects of innovation on warfare. Causes and casualities of digital transformation, and management methods to build a system of transformation. Innovation strategy of the Armed Forces and method of radical innovation. The role of the National Industrial Base in the defence technology research and development.

Educational goal of subject – Competencies:

Gains a general understanding in the generations of warfare with a special focus on the interrelated technical and organizational challenges. Understand the paradigm changes and the challenges presented on the human aspect during Force Modernization. Gets a general overview of the Innovation Toolkit and various methods which can support a Defense Innovation Strategy. General understanding of the digital transformation principles, and its effects on the organizational culture. Has an oveview of the National Industrial Base, and its role in the technological paradigm change.

Required readings:

- Imre Porkolab - Ben Zweibelson: Designing a NATO to Think Differently for 21st Century Complex Challenges, Defence Review 2018/1. ISSN: 2060-1506
- MoD, National Security Through Technology: Technology, Equipment, and Support for UK Defence and Security, Cm 8278 London: The Stationery Office, 2012. ISBN 978-0-10-182782-9
- Robert Work: 'The Third Offset Strategy and America's Allies and Partners', speech given at RUSI, 10 September 2015. ISSN: 0307-1847

Recommenden readings

- Sydney J Freedberg: 'Centaur Army: Bob Work, Robotics, and the Third Offset Strategy', Breaking Defense, 9 November 2015. ISBN-10-3746013577
- Adam Jay Harrison: The Pentagon's Pivot: How Lead Users Are Transforming Defense Product Development, Defense Horizons, 2017. augusztus. ISBN 978-0-16-094499-4
- Imre Porkoláb: Counter Terrorism Exchange Vol 3 No 3, Aug 2013, When the Goldfish meets the Anaconda: A modern fable on unconventional leadership. Internet:
- https://globalecco.org/when-the-goldfish-meets-the-anaconda-a-modern-fable-on-unconventional-leadership

Tantárgy felelőse (*név, beosztás, tud. fokozat*)**: Dr. Porkoláb Imre ezredes, PhD**

Tantárgy oktatásába bevont oktató(k), ha vannak (*név, beosztás, tud. fokozat*)

Title of the course: Ethics of Weapons	**Code: HKDID2421A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training):

Knowledge assessment (exam/academic grade): **classwork**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program): 2-3.

Pre-subject requirements *(if any)*: *none*

Course description:

Historical and contemporary viewpoints, theories and arguments related to weapons research and the application of weapons. Te course examines the basic arguments of historical arms restriction, and the contempoarry debates related to the recently developed weapons or to the weapon systems which are under research. The later category contains nuclear weapons, speace weapons, autonomous weapon system (including the military application of AI), and cyber weapons.

Educational goal of subject - Competencies:

The ability of articulation of arguments concerning the ethical values of researching and application of weapons. This includes historical arguments put forward in the history, worries related to recently developed weapons, and ideas which support their application.

Required readings:

Kavka, Gregory Kavka: Moral Paradoxes of Nuclear Deterrence. Cambridge, CUP, 1987.

Floridi, Luciano-Teddeo, Mariarosia (eds.): The Ethics of Information Warfare. Springer, 2014.

Gillespie, Alexander: A History of the Laws of War. Vol. III. The Customs and Laws of War with regards to Arm Controll. Oxford and Portland: Oregon, 2011.

Leveringhaus, Alex: Ethics and Autonomous Weapons. Plagrave, 2016.

Allhoff, Fritz-Henschke, Adam-Strawser, Bradley Jay: Binay Bullets. The Ethics of Cyberwarfare. Oxford, OUP, 2016.

Recommended readings:

Required readings will be chosen after the agreement with the student on the close topic of the course.

Responsible for course (name, position, scientific degree): Dr. Mihaly Boda PhD head of department, associate professor

Other teachers (name, position, scientific degree):

Title of the course: Hybrid propulsion	**Code: HKDID2237A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 30/10 and 10/6

Knowledge assessment (exam/academic grade): colloquium

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: -

Course description:

Knowledge: Different needs, development opportunities, new directions for drive systems. Possible manifestations of each hybrid drive chain, their advantages, disadvantages, constructional features. Analysis of the usable energy sources, performing the related elementary calculations. Pairing solutions in the hybrid powertrain and their evaluation. Environmental overview. Characteristics of hybrid powertrains in aircraft and in the military environment.

Educational goal of subject - Competencies:

By taking the course, they get an insight into the social, energy and environmental conditions of vehicle hybrid propulsion systems, the needs arising in each operating system and the solution alternatives provided by each hybrid construction. Using elementary calculations in a formative way, they gain insight into new research solutions and possible development directions on an objective basis. They get to know the additional requirements and expectations of aircraft and military equipment in a way that determines their way of thinking.

Required readings:

1. Maria Klingebiel - Michael Bildstein: **Hybrid Drives, Fuel Cells and Alternative Fuels**. Robert Bosch GmbH, 2008. ISBN: 3865224377
2. Denise M. Rizzo: **Current state of military hybrid vehicle development**. International Journal of Electric and Hybrid Vehicles 2011. December (3-4): 369-387. p. DOI:10.1504
3. Bargar, J. Li - D. Goering - J. Lee: **Modeling and Verification of Hybrid Electric HMMWV Performance.** Industrial Electronics Society, 2003, IECON '03, The 29th Annual Conf. of the IEEE 2003, pp. 939-944, 2003.
4. Sándor Hennel: **Analysis of the capacity of the hungarian aviation industry**. Biztonságpolitika: 2013 : 07.02. pp. 1-11. , 11 p. (2013)
5. Piancastelli L. - Pezutti E. - Frizziero: **KERS applications to aerospace diesel propulsion.** ARPN Journal Of Engineering And Applied Sciences, v. 9, no. 5, 2014.

Recommended readings:

1. A. Antoniou - J. Komyathy - J. Bench - A. Emadi: **Modeling and Simulation of Various Hybrid-Electric Configurations of the High-Mobility Multipurpose Wheeled Vehicle (HMMWV)**, IEEE Trans. on Vehicular Technology, Vol. 56. No. 2, March 2007.
2. Piancastelli L. - Daidzic N. E. – Frizziero Rocchi: **Analysis of automotive diesel conversions with KERS for future aerospace applications**. University of Bologna, Italy - Minnesota State University, USA https://doi.org/10.18280/ijht.310119

Responsible for course (name, position, scientific degree): Dr. Hennel Sándor

Other teachers (name, position, scientific degree): Dr. Hennel Sándor

Title of the course: Theory and practice of electronic warfare	**Code: HKDID3101A**	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 40/12 hours / Seminar: 12/4 hours / Consultation: 8/4 hours

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2. semester

Pre-subject requirements *(if any)*: none

Course description:
Basic concepts, categories of electronic warfare (EW) and its connections. Principles and methods of electronic reconnaissance and electronic support measures. Electronic support measures systems. Methods of electronic countermeasures. Basic of electronic jamming. Guided weapons. Directed energy weapons. Electronic countermeasures systems. Principles and methods of electronic protection measures (EPM). EPM of the radar systems as an example. Electronic warfare in army and air force operations. Electronic warfare in the cyberspace.

Educational goal of subject - Competencies:
To give a general overview about the role of electronic warfare in the military operations, as well as make a basis of the electronic warfare.

Required readings:

1. FM 3-36 Electronic Warfare. 2012. http://fas.org/irp/doddir/army/fm3-36.pdf
2. JP 3-13.1 Electronic Warfare. 08 February 2012. https://info.publicintelligence.net/JCS-EW.pdf
3. Haig, Zs.: Convergence between signals intelligence and electronic warfare support measures. Land Forces Academy Review Vol. XIX.:(Nr. 3. (75)) pp. 327-335. (2014) http://www.armyacademy.ro/reviste/rev3_2014/HAIG.pdf
4. Haig, Zs.: Intelligence and electronic warfare on the digital battlefield. Hadmérnök 4. évf.:(3. sz.) pp. 258-264. (2009) http://www.hadmernok.hu/2009_3_haig.pdf

Recommended readings:

1. Adamy, D.: EW101 A First Course in Electronic Warfare. Artech House, 2001.
2. Ryan, M. J. – Frater, M. R.: Tactical communications for the digitized battlefield. Artech House, 2012

Responsible for course (name, position, scientific degree): Dr. Zsolt Haig, professor, PhD

Other teachers (name, position, scientific degree): Dr. habil. Balajti István ret. LtCol. CSc.

Title of the course: Information infrastructures	**Code: HKDID3107A**	**Credits: 6**

Type of lessons and learning hours: lecture
full time training: 60
part time training: 20

Knowledge assessment: exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Information society and its technical history. Infrastructures, information infrastructures, critical infrastructures and critical information infrastructures. Threats against the information infrastructures. Cyberwarfare. Protection of critical information infrastructure. Information security.

Educational goal of subject - Competencies:
To give a general overview on the infrastructures, information infrastructures, critical infrastructures and critical information infrastructures.

Required readings:

1. Lewis, G. Ted: Critical Infrastructure Protection in Homeland Security. Wiley, 2015. ISBN 978-1-118-81763-6

Recommended readings:

1. Green Paper on a European Programme for Critical Infrastructure Protection. Brussels, 17.11.2005. COM(2005) 576 final
2. Kovács László: Possible methodology for protection of critical information infrastructures. in: HADMÉRNÖK IV:(3) pp. 310-322. (2009)

Responsible for course (name, position, scientific degree): Dr. Laszlo Kovacs, professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Cyber terrorism	**Code: HKDID3108A**	**Credits: 6**

Type of lessons and learning hours:
full time training: 60
part time training: 20

Knowledge assessment: exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
History of terrorism. IT in terrorism. IT tools and methods of terrorism. Threats of cyber terrorism. Portection against cyberterrorism.

Educational goal of subject - Competencies:
To give a general overview on cyber terrorism.

Required readings:

1. Haig Zsolt, Kovács László: New way of terrorism: Internet- and cyber-terrorism. in: Academic and Applied Research in Military Science 6:(4) pp. 659-671. (2007)
2. Colarik, A. (2006): Cyber Terrorism: Political and Economic Implications. IGI Global, ISBN 978-1599040219
3. Janczewski, L. (2005): Managerial Guide for Handling Cyber-Terrorism and Information Warfare. Information Science Reference, ISBN 978-1591405832

Recommended readings:

1. Council of Europe: Cyberterrorism: The Use of the Internet for Terrorist Purposes Terrorism and Law. Council of Europe, 2007. ISBN 9287162263, 9789287162267

Responsible for course (name, position, scientific degree): Prof. dr. Laszlo Kovacs, professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Quasi Monostatic – "RF network centric" Air Defence Systems (ADS)	**Code: HKDID3116A**	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 40/12 hours / Seminar: 12/4 hours / Consultation: 8/4 hours

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*:

Course description:
Basic system characterization and performances measures of the Quasi Monostatic - "RF network centric" Air Defence Systems (ADS) and its subsystems in Electronic Warfare (EW) condition. Get relevant, scientifically proven viewpoint and knowledge, which allows determination of:

1. Basic ADS, tasks and its emerging threats; 2. Theoretical analysis on ADS Operation in EW space; 3. EPM/ECCM analysis of radar systems and its modernization requirements; 4. The essence of modern ADS requirements; 5. Requirements, risk and cost estimation, analysis of modern ADS Life Cycle Support.
2. The subject gives solid foundation for understanding of ADS related:

- Quasi Monostatic radar systems` multitasking, characteristic and Radar Trade-Offs;
- Related main system parameters such as: Blake chart and Performance-Driven Specifications, "RF network centric", Passive Radar systems are included, radar technical capabilities and performance calculation.
- Promising scientific findings based on measurement and/or simulation results.

Educational goal of subject - Competencies:
It gives overview on latest, emerging ADS EPM/ECCM technology and its orientation with knowledge on modern SW radar/radio technology, signal processing, IT networks.

Required readings:

1. David K Barton: Radar System Analysis and Modeling. Boston,London, Artech House, 2005
2. Balajti István: Short Study on Performances of Air Surveillance Augmented by Twin Radars ACADEMIC AND APPLIED RESEARCH IN PUBLIC MANAGEMENT SCIENCE 13:(1) pp. 1-16. (2014) (ISBN 1588 8789
3. Istvan Balajti, Gyorgy Kende, Ed Sinner Increased importance of VHF radars in Ground - Based Air Defense, IEEE AEROSPACE AND ELECTRONIC SYSTEMS MAGAZINE 27:(1) pp. 4-18. (2012)

Recommended readings:

1. SKOLNIK: RADAR Handbook, Third Edition, Chapter 6, Mc Graw Hill, 2008,
2. A. De Martino: Introduction to Modern EW Systems, Second Edition, Artech House, 2018, ISBN-13: 978-1630815134,

Responsible for course (name, position, scientific degree): Dr. Balajti István CSc.

Other teachers (name, position, scientific degree): -

Title of the course: Bases of military system's modeling	**Code: HKDID03201A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): : lect.: 15/5; sem.: 8/4; cons..: 7/1.

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*:

Course description:

Bases of general system theory.

Universal model of military system

- inputs
- outputs

Model of armed combat

- environment
- purpose
- subsystems

Special system models

- military robots
- terrorist systems

Educational goal of subject - Competencies:

Creating cybernating sketch model of military tools, systems and processes.

Required readings:

1. Gy. Seres: Bases of military system modeling, http://www.drseres.com/ceepus/
2. Gy. Seres: Military technology comes from club to attack/defense robots by Research and Development (R&D). AARMS, VOL. 3, NO. 3 (2004) 361–372 HTTP://DRSERES.COM/PUBLIK/PDF/R_AND_D.PDF

Recommended readings:

1. Churchman, W.C. (1968) The Systems Approach, Delta, New York, NY,
2. Kis Márta, Seres György: Model of an E-Learning Research Network, Journal of Applied Multimedia 1/XI2016/, pp. 21-28., http://www.jampaper.eu/Jampaper_E-ARC/No.1_XI._2016_files/JAMPAPER160103e.pdf

Responsible for course (name, position, scientific degree): Dr. György Seres, associate professor (ret.), DSc.

Other teachers (name, position, scientific degree):

Title of the course: ICT basis of interactive knowledge transfer	**Code: HKDID3219A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester

Pre-subject requirements *(if any)*: basic ICT skills

Course description: Data, information, knowledge. Knowledge modul. Basic knowledges. Media, multimedia, interactivity. Efficiency of knowledge transfer. Special hardware tools of e-learning. Special software tools of e-learning. Elements of e-teaching. Elements of d-learning. Design of e-curriculums. Design of e-tests.

Educational goal of subject - Competencies:

To give a general overview about hardware and software tools of e-learning and design of e-learning or d-learning materials.

Required readings:

1. György Kende - György Seres - Ildikó Miskolczi: Let's learn easily a,nd quickly – lifelong, anytime, anywhere, Jampeper.eu, 3./III./2008. http://www.jampaper.eu/Jampaper_E-ARC/No.3_III._2008_files/JAM080302e.pdf
2. György Kende - György Seres - Ildikó Miskolczi - Gábor Hangya: Virtual Campus, http://drseres.com/publik/pdf/virtual_campus.pdf
3. György Seres - Antónia Berecz: Mobilizing e-learning, Journal of Applied Multimedia, 2./VIII./2013, pp.53-62 http://jampaper.eu/Jampaper_ENG/Issue_files/JAMPAPER130202e.pdf
4. Márta Kis, György Seres: Model of an E-Learning Research Network, Journal of Applied Multimedia 1./XI./2016 http://www.jampaper.eu/Jampaper_E-ARC/No.1_XI._2016_files/JAMPAPER160103e.pdf
5. György Seres: Is a test this test? , Journal of Applied Multimedia 1./XIII./2018, pp. 1-7. http://www.jampaper.eu/Jampaper_E-ARC/NO.1_XIII_2018/Entries/2018/9/4_Day_of_longboarding_files/JAMPAPER180101e.pdf

Recommended readings:

1. György Seres - Péter Gerő - Ildikó Miskolczi - Krisztina Fórika - Piroska Lengyel: Cloud Learning, CONFERENCE NEW CHALLENGES, 2010, 28-30 September, Budapest, ZMNDU, http://drseres.com/publik/pdf/cloudlearning.pdf
2. Seres, György: A life-to-life teaching-learning process as a system, JOURNAL OF APPLIED MULTIMEDIA 2/XIV/2019, pp. 21-25, http://www.jampaper.eu/Jampaper_E-ARC/No._2_XIV_2019/Entries/2019/10/24_A_life-to-life_teaching-learning_process_as_a_system_files/JAMPAPER190202e.pdf
3. Kis Márta, Seres György: Model of an E-Learning Research Network, JOURNAL OF APPLIED MULTIMEDIA 1/XI2016/, pp. 21-28., http://www.jampaper.eu/Jampaper_E-ARC/No.1_XI._2016_files/JAMPAPER160103e.pdf
4. György Seres: SysAdninLess Club, LAP LAMBERT Academic Publishing, 2020., ISBN-13: 978-620-2-51792-8, https://www.morebooks.de/gb/bookprice_offer_d92707e7f61327b936d6b35f39f6bd3daa262acf

Responsible for course (name, position, scientific degree): Dr. György Seres, assoc. professor (ret.), DSc.

Other teachers (name, position, scientific degree): -Tibenszkiné Dr. Fórika Krisztina, PhD

Title of the course: Information infrastructures	**Code: HKDID3221A**	**Credits: 3**

Type of lessons and learning hours: lecture
full time training: 30
part time training: 10

Knowledge assessment: exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Information society and its technical history. Infrastructures, information infrastructures, critical infrastructures and critical information infrastructures. Threats against the information infrastructures. Cyberwarfare. Protection of critical information infrastructure. Information security.

Educational goal of subject - Competencies:
To give a general overview on the infrastructures, information infrastructures, critical infrastructures and critical information infrastructures.

Required readings:

1. Lewis, G. Ted: Critical Infrastructure Protection in Homeland Security. Wiley, 2015. ISBN 978-1-118-81763-6

Recommended readings:

1. Green Paper on a European Programme for Critical Infrastructure Protection. Brussels, 17.11.2005. COM(2005) 576 final
2. Kovács László: Possible methodology for protection of critical information infrastructures. in: HADMÉRNÖK IV:(3) pp. 310-322. (2009)

Responsible for course (name, position, scientific degree): Dr. Laszlo Kovacs, professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Cyber terrorism	**Code: HKDID3222A**	**Credits: 3**

Type of lessons and learning hours:
full time training: 30
part time training: 10

Knowledge assessment: colloquium

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
History of terrorism. IT in terrorism. IT tools and methods of terrorism. Threats of cyber terrorism. Portection against cyberterrorism.

Educational goal of subject - Competencies:
To give a general overview on cyber terrorism.

Required readings:

1. Haig Zsolt, Kovács László: New way of terrorism: Internet- and cyber-terrorism. in: ACADEMIC AND APPLIED RESEARCH IN MILITARY SCIENCE 6:(4) pp. 659-671. (2007)
2. Colarik, A. (2006): Cyber Terrorism: Political and Economic Implications. IGI Global, ISBN 978-1599040219
3. Janczewski, L. (2005): Managerial Guide for Handling Cyber-Terrorism and Information Warfare. Information Science Reference, ISBN 978-1591405832

Recommended readings:

1. Council of Europe: Cyberterrorism: The Use of the Internet for Terrorist Purposes Terrorism and Law. Council of Europe, 2007. ISBN 9287162263, 9789287162267

Responsible for course (name, position, scientific degree): Dr. Laszlo Kovacs, professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Technical research of the infocommunication support in NATO multinational operations	**Code: HKDID3236A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 16/4 hours / Seminar: 10/4 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

To present the basics of NATO Crisis Response Operations (CRO) and the tasks of the Hungarian Defence Forces (HDF) in NATO multinational operations.

They become familiar with the communication and information support of multinational operations and their technical devices.

To present the principles of NATO CROs, the tasks of allied forces and the system of support.

Analyze the devices, technologies and systems that are used in the multinational operations by the HDF (Iraq, the Balkans, Afghanistan).

Educational goal of subject - Competencies:

The PhD student has to be able to:

- analyze the HDF communication and information system in multinational operations;
- prepare proposals for the communication devices.

Required readings:

1. STANAG 5048; The minimum scale of communications for the NATO land forces - Requirements, principles and procedures; NATO 1995.
2. MC 0593/1; The Minimum Level of C2 Services, Interoperability and Connectivity Required to Ensure Effective Coordination, C2 of Forces and Elements Deployed on Land, Involved in a NATO-led Operation; NATO 2014
3. Allied Joint Doctrine for Communication and Information System AJP-6 ; NATO 2011
4. Formats for orders and designations of timings, locations and boundaries STANAG 2014; NATO 2000.

Recommended readings:

1. Joint Communication System JP 6-0; US 2010.
2. Signal Support to Theater Operations Fm 6-02.45; US 2007.
3. Signal Soldier's Guide Fm 6.02-43; US 2009.

Responsible for course (name, position, scientific degree): Dr. Tibor Farkas, PhD

Other teachers (name, position, scientific degree): -

Subject: **Cloud computing and open source server solutions and their security**	Code: H**KDID3241A**	Credit: **3**
Lesson type and No.: lecture, consultation, full-time: 30 h; correspondence: 10 h		
Exam type: colloquium		
Location in the curriculum: **2-4. semester**		
Prerequisites *(if any)*: no		
Course Description: a brief but informative description of the competences and knowledge needed to be acquired for the completition of the course: **Knowledge:** Basics, types, implementations of cloud computing. Possible directions for development. Applications in the defense sector. Interpreting open source. Server types. Implementing different servers with open source applications. Theoretical and practical knowledge of security considerations. During the seminar, a research subtask related to the research topic of the doctoral student will be carried out Presentation of the results in the form of a seminar paper is expected. **Competence:** Acquisition of theoretical and practical knowledge in the field of cloud computing and open source servers, as well as acquisition of scientific publishing practice.		
List of the 3-5 most important required or recommended literature (notes, textbooks) with bibliographic data (author, title, edition details, pages, ISBN) **Required and recommended literature:** Andrew S. Tanenbaum, David J. Wetherall: Computer networks ISBN 978-963-545-529-4 Wireshark Network Analisys (Second edition) ISBN 978-1-893939-90-5 Brian W. Kernighan, Rob Pike: THE UNIX OS ISBN 963-16-0498-5 Mandatory and recommended literature is constantly updated, taken in consideration the results related to the topic, developments and plans of the Hungarian Armed Forces , as well as the available literature of the armies of NATO member states.		
Responsible for the subject: Dr. János, Rikk PhD		
Instructor involved in the teaching of the subject, if any: no		

Title of the course: Introduction to cryptography	**Code: HKDID3243A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 30/10

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester

Pre-subject requirements *(if any)*: none

Course description:

Simple substitution ciphers. Caesar cipher, Hill cipher, one-time pad. Basic concepts and methods in cryptanalysis. Discrete Logarithms and Diffie–Hellman key exchange protocol. Symmetric key cryptosystems. Stream ciphers and block ciphers. Public key cryptography. The ElGamal public key cryptosystem. Integer factorization problem and the RSA cryptosystem. Hash Functions and Applications. Hash collision attack and the birthday paradox. Zero-Knowledge Proofs.

Educational goal of subject - Competencies:

To give a general overview about the basics concepts and protocols of cryptography, as well as their mathematical background.

Required readings:

1. J. Hoffstein, J. Pipher, and J.H. Silverman: An introduction to mathematical cryptography. Springer, 2008.
2. G. Baumslag, B. Fine, M.Kreuzer, and G. Rosenberger: A Course in Mathematical Cryptography. De Gruyter, 2015.
3. L. V. Houtven: Crypto 101. 2017. https://www.crypto101.io
4. D. R. Stinson and M. B. Paterson: Cryptography: Theory and practice. Chapman & Hall/CRC Press, 2019.

Recommended readings:

1. D. Boneh and V. Shoup: A Graduate Course in Applied Cryptography. 2017 https://toc.cryptobook.us/
2. X. Wang, G. Xu, M. Wang, and X. Meng: Mathematical Foundations of Public Key Cryptography. Chapman & Hall/CRC Press 2016.
3. J. Katz and Y. Lindell: Introduction to Modern Cryptography. Chapman & Hall/CRC Press 2014.

Responsible for course (name, position, scientific degree): Dr. Gergely Székely, associate professor, PhD

Other teachers (name, position, scientific degree): –

Title of the course: "In Situ" Radar-, Electronic Protection Measures (EPM/ECCM), Performance Checks (RPC) for researchers	**Code: HKDID3246A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4 semester

Pre-subject requirements *(if any)*: Basic radar and EW theory

Course description:
Important of "in-situ" RPC, focused on EPM/ECCM, in moder radar logistic support. Challenges in complex radar diagnosis. Objectives of RPC and "in-situ" test results evaluation with scientifically proven criterias and their syntheses. Radar Blake chart calculations and Performance Checks-Driven Parameters. Applied in the field RPC concept and structure: System specific Built In Tests. EPM/ECCM and Antenna Performance characterisation and testing. Transmitter related; Receiver related; Signal and Data processing; Plot recording tests and its analysis defficulties. Requirements for practical realisations of test methods and equipments such as DRFM on drone platform. Test results and data base maintanence. Future grow of RSP.

Educational goal of subject - Competencies:
To give overview on the possibilities how to get the maximum available information regularly regarding a radar under "in-situ" tests within a minimum required downtime and cost. Highlight important of "in-situ" radar, EPM/ECCM performance tests for radar Life Cycle Support.

Required readings:

1. **BARTON, David K.** (2005): Radar system analysis and modeling. Boston, Artech House. 545 p. ISBN 1-580536-81-6
2. **BALAJTI, I. (2008):** Performance measurements of the radar "In Situ". In: Microwaves, Radar and Remote Sensing Symposium, MRRS 2008. Kiev, Ukraine, 22-24 September, 2008. p. 334-339
3. **BALAJTI, I. (2010):** Performance measurements of the radar "In Situ": Beam pointing and transmitter related issues. In: IEEE Radar Conference, Washington D.C, USA, 10-14 May 2010. p. 6-11.

Recommended readings:

1. A. De Martino: Introduction to Modern EW Systems, Second Edition, Artech House, 2018, ISBN-13: 978-1630815134.

Responsible for course (name, position, scientific degree): Dr. István Balajti CSc

Other teachers (name, position, scientific degree):

Title of the course: Modern technological and organizational processes in the management of battlefield infocommunication networks	**Code: HKDID3247A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 16/4 hours / Seminar: 10/4 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
To present the national and NATO organizational methods of battlefield military communication and information systems (CIS), and the modern communication and information equipments.
PhD students learn about the personal conditionality of the CIS management.
They become familiar with the survey methodology of communication needs in battlefield communication, and the features of modern communication devices and technologies related to the organizational methodology.

Educational goal of subject - Competencies:
The PhD student has to be able to plan military communication network , and become familiar with modern technology and organizational procedures.

Required readings:

1. STANAG 5048; The minimum scale of communications for the NATO land forces - Requirements, principles and procedures; NATO 1995.
2. MC 0593/1; The Minimum Level of C2 Services, Interoperability and Connectivity Required to Ensure Effective Coordination, C2 of Forces and Elements Deployed on Land, Involved in a NATO-led Operation; NATO 2014
3. Allied Joint Doctrine for Communication and Information System AJP-6 ; NATO 2011

Recommended readings:

1. Joint Communication System JP 6-0; US 2010.
2. Signal Support to Theater Operations Fm 6-02.45; US 2007.
3. Signal Support to Operations FM 6-02; US 2014.

Responsible for course (name, position, scientific degree): **Dr. Tibor Farkas, PhD**

Other teachers (name, position, scientific degree): -

Title of the course: The First Hungarian Critical Infrastructure Protection Research Project, and ongoing researches.	**Code: HKDID3249A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): lecture/20 hours/6 hours

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*:

Course description: National University of Public Service and Óbuda University applied together, for the Hungarian Government tender titled "TÁMOP-4.2.1.B-11/2/KMR-2011-0001 promotion of research projects and research services in Central Hungary" in 2011. As a result of the positive tender evaluation they won altogether ~3,167,000 € financial support from which the ÓU could use ~1,749,864 € and the NUPS could use ~1,417,143 € to accomplish the approved research objectives. After the successful tender the two beneficiaries created a consortium named "Critical Infrastructure Protection Researches". With the realization of the Project the employment of 112 lecturers, 30 experts, 28 future lecturers, 33 foreign experts, the publishing of 132 articles, 11 books, the submission of 4 patents, the organization of 140 conference-presentations, the development of 43 studies and strategies and the writing of 70 other scientific dissertations were set as a goal. The above requirements have been accomplished in some areas significantly over fulfilled during the 27-month course of the Project. The results of the research have been received with sincere renown in professional, academic, governmental and social circles.

Educational goal of subject - Competencies:

The doctoral candidates are taking this course, will examine the results and indicators of the first Hungarian Critical Infrastructure Protection Research Project, the professional developments of the critical infrastructure protection period since the terminated of the Project, the technological innovations and the new research directions and trends, together with the class director who was the project manager of the above mentioned 27-month research.

Required readings:

1.) Tibor Babos: *„The First Critical Infrastructure Protection Project in Hungary"*, Nádai, László, Padányi, József , *„Critical Infrastructure Protection Research, Results of the First Critical Infrastructure Protection Research Project in Hungary"*, Óbuda University, Springer International Publishing, Budapest, 2014.

2.) *„Critical Infrastructure Protection Research, Results of the First Critical Infrastructure Protection Research Project in Hungary"*, edited by Nádai, László, Padányi, József, Óbuda University, Springer International Publishing, Budapest, 2014.

Recommended readings:

1.) Ted G. Lewis: „*Critical Infrastructure Protection in Homeland Security, Defending a Networked Nation"*, Wiley, New Jersey, 2015.

2.) „Critical Infrastructure Protection VIII", edited by Jonathan Butts and Sujeet Shenoi, Springer, Heidelberg, New York, Dordrecht, London, 2014.

3.) „Critical Infrastructure Protection" edited by Matthew Edwards, IOS Press, Amsterdam, 2015.

Responsible for course (name, position, scientific degree): Tibor Babos Ph.D., private professor

Other teachers (name, position, scientific degree): -

Title of the course: Application of GIS in defence electronics systems	**Code: HKDID3407A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 6/2 hours / Seminar: 4/2 hours / Consultation: 10/2 hours

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Basics of GIS. General overview of GIS systems. Data collection, data processing, data analysis processes in GIS systems. Applications of GIS in the defence electronics systems. GIS analysis. Radio wave propagation supported by GIS. GIS-based C2 systems.

Educational goal of subject - Competencies:
To give a general overview about the GIS in defence electronics systems. The result of this practical course is a manuscript in the context of GIS and electronics systems.

Required readings:

1. Prof. Tamás János; Fórián Tünde: Geoinformatics. Debreceni Egyetem, 2008. https://regi.tankonyvtar.hu/hu/tartalom/tamop425/0032_terinformatika/index.html
2. Li Qing: GIS Aided Radio Wave Propagation Modelling and Analysis. May 12, 2005. http://scholar.lib.vt.edu/theses/available/etd-05272005-140752/unrestricted/Thesis_LiQing.pdf

Recommended readings:

1. GIS in the Defense and Intelligence Communities, Volume 2. ESRI http://www.esri.com/library/brochures/pdfs/gis-in-defense-vol2.pdf

Responsible for course (name, position, scientific degree): Dr. Zsolt Haig, professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Ruggedized IT devices	**Code: HKDID3409A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 0/0 hours / Seminar: 0/0 hours / Consultation: 20/6

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
During the research seminar, a research subtask – related to the application of ruggedized IT devices, and to the PhD research topic of the PhD student – will be conducted, guided by the teacher. The result of the seminar, and the basis of the evaluation is a seminar paper, similar in content and format to a scientific journal paper.

Educational goal of subject - Competencies:
To ensure progress in formulating research subtask objectives, in processing the relevant scientific literature, in formulating scientific results, and in presenting the results in accordance the basic requirements of scientific publications.

Required readings:
Recommended readings:
- as follows from the guided research nature of the research seminar, no specific literature can be given;

Responsible for course (name, position, scientific degree): Dr. Sándor Munk, prof. em., DSc

Other teachers (name, position, scientific degree): none

Title of the course: Personal and wearable IT devices	**Code: HKDID3410A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 0/0 hours / Seminar: 0/0 hours / Consultation: 20/6

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
During the research seminar, a research subtask – related to the application of personal and wearable IT devices, and to the PhD research topic of the PhD student – will be conducted, guided by the teacher. The result of the seminar, and the basis of the evaluation is a seminar paper, similar in content and format to a scientific journal paper.

Educational goal of subject - Competencies:
To ensure progress in formulating research subtask objectives, in processing the relevant scientific literature, in formulating scientific results, and in presenting the results in accordance the basic requirements of scientific publications.

Required readings:
Recommended readings:
- as follows from the guided research nature of the research seminar, no specific literature can be given;

Responsible for course (name, position, scientific degree): Dr. Sándor Munk, prof. em., DSc

Other teachers (name, position, scientific degree): none

Title of the course: Information infrastructures	**Code: HKDID3415A**	**Credits: 2**

Type of lessons and learning hours: seminar
full time training: 20
part time training: 6

Knowledge assessment: academic grade

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Information society and its technical history. Infrastructures, information infrastructures, critical infrastructures and critical information infrastructures. Threats against the information infrastructures. Cyberwarfare. Protection of critical information infrastructure. Information security.

Educational goal of subject - Competencies:
To give a general overview on the infrastructures, information infrastructures, critical infrastructures and critical information infrastructures.

Required readings:

1. Lewis, G. Ted: Critical Infrastructure Protection in Homeland Security. Wiley, 2015. ISBN 978-1-118-81763-6

Recommended readings:

1. Green Paper on a European Programme for Critical Infrastructure Protection. Brussels, 17.11.2005. COM(2005) 576 final
2. Kovács László: Possible methodology for protection of critical information infrastructures. in: HADMÉRNÖK IV:(3) pp. 310-322. (2009)

Responsible for course (name, position, scientific degree): Dr. Laszlo Kovacs, professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Cyber terrorism	**Code: HKDID3416A**	**Credits: 2**

Type of lessons and learning hours:
full time training: 20
part time training: 6

Knowledge assessment: academic grade

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
History of terrorism. IT in terrorism. IT tools and methods of terrorism. Threats of cyber terrorism. Portection against cyberterrorism.

Educational goal of subject - Competencies:
To give a general overview on cyber terrorism.

Required readings:

1. Haig Zsolt, Kovács László: New way of terrorism: Internet- and cyber-terrorism. in: ACADEMIC AND APPLIED RESEARCH IN MILITARY SCIENCE 6:(4) pp. 659-671. (2007)
2. Colarik, A. (2006): Cyber Terrorism: Political and Economic Implications. IGI Global, ISBN 978-1599040219
3. Janczewski, L. (2005): Managerial Guide for Handling Cyber-Terrorism and Information Warfare. Information Science Reference, ISBN 978-1591405832

Recommended readings:

1. Council of Europe: Cyberterrorism: The Use of the Internet for Terrorist Purposes Terrorism and Law. Council of Europe, 2007. ISBN 9287162263, 9789287162267

Responsible for course (name, position, scientific degree): Prof. dr. Laszlo Kovacs, professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Internet-based IT Services	**Code: HKDID3419A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 0/0 hours / Seminar: 0/0 hours / Consultation: 20/6

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
During the research seminar, a research subtask – related to the Internet-based IT services, and to the PhD research topic of the PhD student – will be conducted, guided by the teacher. The result of the seminar, and the basis of the evaluation is a seminar paper, similar in content and format to a scientific journal paper.

Educational goal of subject - Competencies:
To ensure progress in formulating research subtask objectives, in processing the relevant scientific literature, in formulating scientific results, and in presenting the results in accordance the basic requirements of scientific publications.

Required readings:
Recommended readings:
- as follows from the guided research nature of the research seminar, no specific literature can be given;

Responsible for course (name, position, scientific degree): Dr. Sándor Munk, prof. em., DSc

Other teachers (name, position, scientific degree): none

Title of the course: Development trends in the deployable infocommunication and information system	**Code: HKDID3428A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 6/2hours / Seminar: 10/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

To present the deployable communication and information system (CIS) of the modern armed forces, and the current field of the recent development.

To examine the future directions in technical development highlighted the experiences.

The PhD students become familiar with the battlefield CIS by interpretation of doctrinal, technical, and technologial development.

Educational goal of subject - Competencies:

The PhD student has to be able to:

- analyze the communication and information system;
- interpret the capability based approach development.

Required readings:

1. STANAG 5048; The minimum scale of communications for the NATO land forces - Requirements, principles and procedures; NATO 1995.
2. MC 0593/1; The Minimum Level of C2 Services, Interoperability and Connectivity Required to Ensure Effective Coordination, C2 of Forces and Elements Deployed on Land, Involved in a NATO-led Operation; NATO 2014
3. Allied Joint Doctrine for Communication and Information System AJP-6 ; NATO 2011
4. Formats for orders and designations of timings, locations and boundaries STANAG 2014; NATO 2000.

Recommended readings:

1. Joint Communication System JP 6-0; US 2010.
2. Signal Soldier's Guide Fm 6.02-43; US 2009.

Responsible for course (name, position, scientific degree): Dr. Tibor Farkas, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Issues of infocommunication capabilities, applications and technical equipment in the joint operations of the Hungarian Defense Forces	**Code: HKDID3429A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 6/2hours / Seminar: 10/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
To present the:

-capabilities of communication suppport for joint forces;

-the capabilities of Communication and information System (CIS);

-and the requirements, needs by the commanders.

The Phd Students become familiar with the structure, capability of joint forces and features of their CIS and communication devices.

Educational goal of subject - Competencies:

The PhD student has to be able to analyze and to organize the CIS support of joint forces.

Required readings:

1. STANAG 5048; The minimum scale of communications for the NATO land forces - Requirements, principles and procedures; NATO 1995.
2. MC 0593/1; The Minimum Level of C2 Services, Interoperability and Connectivity Required to Ensure Effective Coordination, C2 of Forces and Elements Deployed on Land, Involved in a NATO-led Operation; NATO 2014
3. Allied Joint Doctrine for Communication and Information System AJP-6 ; NATO 2011

Recommended readings:

1. Signal Support to Theater Operations Fm 6-02.45; US 2007.
2. Signal Support to Operations Fm 6-02; US 2014.

Responsible for course (name, position, scientific degree): Dr. Tibor Farkas, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Cybersecurity in Public Administration	**Code: HKDID3431A**	**Credits: 2**

Type of lessons (lecture/seminar/practice/consultation) **and learning hours** (full time training/part time training): 6(FT), 2(PT); 14(Pr), 4(Pr)

Knowledge assessment (exam/academic grade): **academic grade**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*:

Course description:
A country's social and economic operation depends on the information systems that we call critical information infrastructures. Information systems of the public administration are extremely critical, where secure operation is especially important. As cyber attacks are becoming more common, the risk level of such systems is getting higher. The goal of the course is to introduce the principles of cybersecurity and critical information infrastructure protection on a level that users of public information systems need to know.

Educational goal of subject - Competencies:

- Is able to see the current threats of cyberspace towards public administration,
- Is able to support its pulic administration organization in developing cyber defense capabilities;
- Is able to adequately support its public administration organization and external parties in dealing with cyber attacks.

Required readings:

1. Dr Katharina Ziolkowski (Ed.) (2014): Peacetime Regime for State Activities in Cyberspace

Recommended readings:

1. NATO CCDCOE (2018): Guide to Developing a National Cybersecurity Strategy

Responsible for course (name, position, scientific degree): Csaba Krasznay, associate professor, PhD

Other teachers (name, position, scientific degree):

Title of the course: Legal aspects of cybersecurity in the European Union	**Code: HKDID3444A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Full time training: 20/6

Knowledge assessment (exam/academic grade): **Term mark**

The course place in the curricula (in which semester): 2-4. semester

Pre-subject requirements *(if any)*: *working knowledge of English language*

Course description:
The main objective of the course is to provide a structured and comprehensive understanding of the cybersecurity regulatory framework in the European Union, including current challenges and trends. Students learn about the most relevant legislative and non-legislative instruments related to cybersecurity in the EU, which will help them understand the focus, scope, aims, content and limitations of using laws as a tool to address cybersecurity challenges. Distinction will be made between instruments that are made for the purposes of addressing one or more issues related to cybersecurity (e.g. NIS Directive), and instruments with sectoral focus where security is an integral element, but not a primary aim of regulation (e.g. telecom or consumer protection). In addition to dicussing the application of current framework and pointing out the link between internal and external policies of the EU, new initiatives and legislative proposals are presented and analysed.
Educational goal of subject - Competencies:
Knowledge: He/she is familiar with the regulatory framework related to cybersecurity in the European Union.
Capabilities: He/she is able to analyse cases or specific legal problems related to cybersecurity.
Attitude: His/her attitude is characterised by understanding and acceptance of the role of law in the complex domain of cybersecurity and thus strives to account for this role in his/her work.
Autonomy and responsibility: Having the autonomy and responsibility to take into account legal aspects of cybersecurity in his/her practice.

Required readings:
Ramses A. Wessel, European law and cyberspace. In: Nicholas Tsagourias and Russell Buchan, Research Handbook on International Law and Cyberspace, Elgar Publishing, 2021, eISBN: 9781789904253, DOI: https://doi.org/10.4337/9781789904253
Vagelis Papakonstantinou, Cybersecurity as praxis and as a state: The EU law path towards acknowledgement of a new right to cybersecurity?, Computer Law & Security Review, Volume 44, 2022, 105653, ISSN 0267-3649, https://doi.org/10.1016/j.clsr.2022.105653.
Texts of normative material (EU directives, regulations, communications, etc.) discussed during lectures.
Recommended readings:
Agnes Kasper and Alexander Antonov, 'Towards Conceptualizing EU Cybersecurity Law' (2019) ZEI Discussion Paper C253;
Gloria González Fuster and Lina Jasmontaite, 'Cybersecurity Regulation in the European Union: The Digital, the Critical and Fundamental Rights', in M. Christen et al. (eds.), The Ethics of Cybersecurity, The International Library of Ethics, Law and Technology (Springer, 2020);
Faye F. Wang, 'Legislative Developments in Cybersecurity in the EU' (2020), 1 Amicus Curiae 2, 233-59.

Responsible for course (name, position, scientific degree): Kasper Ágnes, Senior Lecturer

Title of the course: Environmental Protection and Security	**Code:** HKDID4102A	**Credits:** 6

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 40/12 hours / Seminar: 12/4 hours / Consultation: 8/4

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: Military Technology

Course description:
Environmental protection and economics. Ecology, ecosystems. Legal environment of environmental protection, acts and other regulations. Environmental security. Environmental principles in the NATO. Air, water and soil quality management. Waste and hazardous waste management. Electromagnetic waves, vibration and noise protection. Environmental protection during military activities.

Educational goal of subject - Competencies:
To give a general overview about environmental protection, as well as make a basic knowledge of environmental security and related global threats and problems.

Required readings:

1. Rita Floyd, Richard A. Matthew: Environmental Security: Approaches and Issues, Routledge, 2013. ISBN 978-041-5538-99-2
2. Simon Dalby: Environmental security, University of Minnesota Press, 2002. p. 312, ISBN 978-0-8166-4026-3
3. Institutions for the Earth: Sources of Effective International Environmental Protection, Edited by Peter M. Haas, Robert O. Keohane and Marc A. Levy; MIT Press, 1993. p. 448, ISBN: 978-026-2581-19-6

Recommended readings:

1. Ackerman, Frank; Heinzerling, Lisa: Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection; Law Journal Library, Heinonline, https://heinonline.org/HOL/PrintRequest?collection=journals&handle=hein.journals/pnlr150&id=1567&print=section&div=42&ext=.pdf&format=PDFsearchable&submit=Print%2FDownload

Responsible for course (name, position, scientific degree): Prof. dr. László Földi, PhD

Other teachers (name, position, scientific degree): Prof. Em. László Halász, DSc

Title of the course: Chemical Safety	**Code:** HKDID4105A	**Credits:** 6

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 40/12 hours / Seminar: 12/4 hours / Consultation: 8/4

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Cefinition of chemical safety, Act 25/2000. and the national program of chemical safety. Chemical risk assesment and risk management. Categories of dangerousness and report obligations. The system of REACH regulation in the European Union and its implementation in Hungary. Effects and tasks emanating from the GHS/CLP regulations.

Educational goal of subject - Competencies:
To give advanced capabilities in safe handling of different hazardous chemicals.

Required readings:

1. Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), EC No 1907/2006.
2. CLP Regulation (for "Classification, Labelling and Packaging"), EC No 1272/2008

Recommended readings:

1. Globally Harmonized System of Classification and Labeling of Chemicals (GHS), United Nations Economic Commission for Europe, http://www.unece.org/trans/danger/publi/ghs/ghs_rev05/05files_e.html

Responsible for course (name, position, scientific degree): Prof. dr. László Földi, PhD

Other teachers (name, position, scientific degree): Prof. Em. László Halász, DSc

Title of the course: **Environmental Radiology**	**Code: HKDID4108A**	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 40/12 hours / Seminar: 12/4 hours / Consultation: 8/4

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: -

Course description:
Environmental radiology is concerned with the relationship of naturally occurring radioactive materials (NORM) and technologically enhanced naturally occurring radioactive materials (TENORM) or artificial radioactive isotopes in the biosphere to our natural environment. The course provides a basic knowledge of the appearance and behaviour of NORM and TENORM substances in our environment, the relationship between TENORM substances and artificial isotopes and the "human footprint", as well as nuclear and chemical measurement techniques and data processing methods used in scientific research on the subject.

Educational goal of subject - Competencies:
The student will gain a comprehensive understanding of the relationship between radioactive substances in our environment and the ecosystem, their possible interactions, civilisation effects and methods of investigation. After completing the course, the student will be able to study and analyse the isotopes and their interactions in the environmental radiation field, both theoretically and practically.

Required readings:

Compulsory literature is determined solely by the topic of the student wishing to research the subject

Recommended readings:

1. F. Ward Whicker, Ph.D.; Vincent Schultz, Ph.D.: Radioecology: Nuclear Energy and the Environment; Library of Congress Cataloging in Publication Data, 1982 by CRC Press, Inc., ISBN 0-8493-5353-X https://hwbdocuments.env.nm.gov/Los%20Alamos%20National%20Labs/TA%2021/10462.pdf
2. Outola, I. & al.:Characterization of the NIST seaweed Standard Reference Material, International Conference on Radionuclide Metrology and its Applications, 15. Applied radiation and isotopes, Vol.64, No. 10/11 (October-November 2006), 1242-1247
3. Koteles, G.J.: On the Radio-ecology of the Danube River, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.565.2685&rep=rep1&type=pdf

Responsible for course (name, position, scientific degree): Dr. József Csurgai PhD

Other teachers (name, position, scientific degree):

Title of the course: Weapons of mass destruction	**Code: HKDID4201A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Characteristics and Effects of CBRN Hazards. Environmental Effects. Chemical Hazards Characteristics and Effects. Biological Hazards Characteristics and Effects. Radiological Hazards Characteristics and Effects. Nuclear Hazards Characteristics and Effects. Principles of CBRN Defence. CBRN in the Operational Environment. Individual protection, collective protection. CBRN recce, CBRN decontamination.

Educational goal of subject - Competencies:
To give a general overview about the CBRN weapons and effects. To give knowledge about Fundamentals of CBRN Defence.

Required readings:

1. AJP-3.8 Allied Joint Doctrine for NBC, 2003.
2. STANAG 2112 Nuclear, biological and chemical reconnaissance, 2005.
3. Rezső Pellérdi - Tamás Berek: Redefining the CBRN risk assessment, AARMS - 2009 Vol 8. Issue12, pp. 159-172., 2009.

Recommended readings:

1. Berek Tamás: Conditions of an NBC exercise field creation ***HADMÉRNÖK*** **2:**(3) *pp. 4-8.* (2007)
2. L Halász, I Pintér, A Solymár: Remote sensing in the biological and chemical reconnaissance. ***ACADEMIC AND APPLIED RESEARCH IN MILITARY SCIENCE*** **1:**(1) *pp. 39-56.* (2002)
3. A Solymár, L Halász: Biological detection ***ACADEMIC AND APPLIED RESEARCH IN MILITARY SCIENCE*** **1:**(1) *pp. 57-62.* (2002)
4. Berek Tamás, Szabó Sándor: Hungarian establishing test of CBRN decontamination technologies from the aspect of CBRN decon platoon composition ***HADMÉRNÖK*** **9:**(2) *pp. 226-233.* (2014)
5. Halász László, Földi László, Padányi József: Climate change and CBRN defense ***HADMÉRNÖK*** **7:**(3) *pp. 42-49.* (2012)
6. Földi László: Current status of chemical and biological weapons' development, trends, possibilities and prospects HADMÉRNÖK 10 : 4 pp. 75-85. , 11 p. (2015)

Responsible for course (name, position, scientific degree): Dr. Tamas Berek associate professor, PhD

Other teachers (name, position, scientific degree):
László Halász, professor emeritus, DSc

Title of the course: Chemistry of toxic materials	**Code:** HKDID4202A	**Credits:** 3

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Basics of toxicology. Active ingredients of chemical weapons. Types of chemical warfare agents: nerve agents (organophosphates, karbamates, highly toxic insecticides, binery nerve agents), blister agents (halogenated thioethers, nitrogene mustards, lewisite and its homologs), choking agents, generally toxic agents, non-lethal chemical agents (psychotoxic and somatic agents), herbicides, toxins.

Educational goal of subject - Competencies:
To achieve basic knowledge on the chemical structure and physico-chemical properties of chemical warfare agents, their production and chemical reactions, biological mode of action

Required readings:

1. Dr Timothy T. Marrs (Editor), Robert L. Maynard (Editor), Frederick Sidell (Editor): Chemical Warfare Agents: Toxicology and Treatment, 2007, ISBN-13: 978-0470013595
2. Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction (CWC), http://www.opcw.org/chemical-weapons-convention/

Recommended readings:

1. Richardt, Andre (2013), CBRN Protection: Managing the Threat of Chemical, Biological, Radioactive and Nuclear Weapons, Germany: Wiley-VCH Verlag & Co., ISBN 978-3-527-32413-2.
2. Stöhr, Ralf (Hrsg.)(1977): Chemische Kampfstoffe und Schutz vor chemischen Kampfstoffen, Berlin(-Ost), Militärverlag der DDR.

Responsible for course (name, position, scientific degree): Prof. László Földi, PhD

Other teachers (name, position, scientific degree): Prof. Em. László Halász, DSc

Title of the course: Radio-ecology	**Code:** HKDID4206A	**Credits:** 3

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: Military Technology

Course description:
Radioecology is a scientific discipline which studies how radioactive substances interact with nature; how different mechanisms affect the substances' migration and uptake in food chain and ecosystems. Investigations in radioecology includes aspects of field sampling, designed field and laboratory experiments and the development of predictive simulation models.

Educational goal of subject - Competencies:
Giving a basics for detection and investigation of presence and environmental distribution of radioactive materials and their influence. Overviewing amount of nuclear emission and immission, the ways of control, and its effect on the population in case of different nuclear facilities. Giving general overview for Hungarian nuclear environmental protection underlining Paks NPP.

Required readings:

4. F. Ward Whicker, Ph.D.; Vincent Schultz, Ph.D.: Radioecology: Nuclear Energy and the Environment; Library of Congress Cataloging in Publication Data, 1982 by CRC Press, Inc., ISBN 0-8493-5353-X https://hwbdocuments.env.nm.gov/Los%20Alamos%20National%20Labs/TA%2021/10462.pdf

Recommended readings:

1. Outola, I. & al.:Characterization of the NIST seaweed Standard Reference Material, International Conference on Radionuclide Metrology and its Applications, 15. Applied radiation and isotopes, Vol.64, No. 10/11 (October-November 2006), 1242-1247
2. Koteles, G.J.: On the Radio-ecology of the Danube River, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.565.2685&rep=rep1&type=pdf

Responsible for course (name, position, scientific degree): Dr. József Csurgai PhD

Other teachers (name, position, scientific degree):

Title of the course: Non-proliferation actions against the weapons of mass destruction	**Code:** HKDID4208A	**Credits:** 3

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: Military Science, Military Technology

Course description:
History of nuclear, biological and chemical weapons till nowadays. Actual proliferation issues of CBRN weapons. Structure and operation of international non-proliferational agreements and organizations. Presentation of our domestic and international responsibilities and tasks. International inspection missions on the weapons of mass destruction.

Educational goal of subject - Competencies:
To give comprehensive knowledge on properties of weapons of mass destruction and their proliferation. Also a general overview on international agreements and organizations related to control of weapons of mass destruction, and the work of United Nations weapons inspectors.

Required readings:

1. Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction (CWC), http://www.opcw.org/chemical-weapons-convention
2. Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, Signed at London, Moscow and Washington on 10 April 1972. Entered into force on 26 March 1975.

Recommended readings:

1. Richardt, Andre (2013), CBRN Protection: Managing the Threat of Chemical, Biological, Radioactive and Nuclear Weapons, Germany: Wiley-VCH Verlag & Co., ISBN 978-3-527-32413-2.
2. http://www.iaea.org
3. http://www.ctbto.org
4. http://www.unmovic.org

Responsible for course (name, position, scientific degree): Prof. László Földi, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Environmental management	**Code:** HKDID4210A	**Credits:** 3

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
State and protection of the key elements of the environment and our natural resources. Principles of environmental management. Actions against economic and military threats to the environment, prevention, local, regional and global tasks and actions.

Educational goal of subject - Competencies:
To give comprehensive overview on the natural resources and the elements of the environment, their man-made damages and activities to protect them. Also knowledge on the task of environmental planning and environmental development.

Required readings:

1. Chris Barrow: Environmental Management for Sustainable Development, Routledge, 2006. ISBN-13: 978-0415365352
2. Gwendolyn Burke, Ben Ramnarine Singh, Louis Theodore: Handbook of Environmental Management and Technology, Wiley-Interscience; 2012. ISBN-13: 978-0471722373

Recommended readings:

1. Ecosystem Health: New Goals for Environmental Management; Edited by: Robert Costanza, Bryan G. Norton, Benjamin D. Haskell, Island Press, Washington, D.C. 1992; ISBN 1-55963-140-6

Responsible for course (name, position, scientific degree): Prof. László Földi, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Nature conservation	**Code:** HKDID4211A	**Credits:** 3

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Relations between environmental protection and nature conservation. History of nature conservation. Structure of nature conservation organization in Hungary. Legal regulations on nature conservation. International nature conservation agreements and organizations. EU legizlations on nature conservation. Categories of nature conservation interest. Evaluation systems on nature conservation.

Educational goal of subject - Competencies:
To give detailed knowledge for practical applications of nature conservation information.

Required readings:

1. Peter Bromley: Nature Conservation in Europe: Policy and Practice, Taylor & Francis, 2012. ISBN 978-113-5158-5-90

Recommended readings:

1. Theo Colborn, Dianne Dumanoski and John Peter Meyers: Our Stolen Future; Published by Plume1997, ISBN-10: 0452274141, ISBN-13: 978-0452274143

Responsible for course (name, position, scientific degree): Prof. László Földi, PhD

Other teachers (name, position, scientific degree):

Title of the course: Technologies of monitoring and extermination of weapons of mass destruction	**Code:** HKDID4215A	**Credits:** 3

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: Military Science, Military Technology

Course description:
Governmental responsibilities from international non-proliferation and arms control agreements of nuclear, biological and chemical weapons. International inspection tasks of surveillance, monitoring and destruction of CBRN weapons stockpiles. Lessons learned from international inspection missions on the weapons of mass destruction.

Educational goal of subject - Competencies:
To give basic knowledge on the technical issues of destruction of arms and stockpiles of weapons of mass destruction, and also on the application and future development of destruction technologies.

Required readings:

1. Richardt, Andre (2013), CBRN Protection: Managing the Threat of Chemical, Biological, Radioactive and Nuclear Weapons, Germany: Wiley-VCH Verlag & Co., ISBN 978-3-527-32413-2.
2. Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction (CWC), http://www.opcw.org/chemical-weapons-convention/
3. Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, Signed at London, Moscow and Washington on 10 April 1972. Entered into force on 26 March 1975.

Recommended readings:

1. http://www.iaea.org
2. http://www.ctbto.org
3. http://www.unmovic.org

Responsible for course (name, position, scientific degree): Prof. László Földi, PhD

Other teachers (name, position, scientific degree): Dr. József Csurgai, PhD

Title of the course: NBC threat analysis of the territory of Hungary	**Code:** HKDID4216A	**Credits:** 3

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: Military Technology

Course description:
Investigating potential sources of NBC (CBRN) threats in way of analising chemical and biological industrial objects and nuclear facilities. Comparative analysis of Hungarian and other NPPs. Radioactive waste management. Chemical facilities, transport of chemicals. Investigation meteorological particularities of Hungary for analysis of spreading NBC contamination.

Educational goal of subject - Competencies:
To give a general overview for investigating potential sources of HAZARD situations in Hungary.

Required readings:

1. ATP-45(D) WARNING AND REPORTING AND HAZARD PREDICTION OF CHEMICAL, BIOLOGICAL, RADIOLOGICAL AND NUCLEAR INCIDENTS (OPERATORS MANUAL)
2. AEP-45(C) WARNING AND REPORTING AND HAZARD PREDICTION OF CHEMICAL, BIOLOGICAL, RADIOLOGICAL AND NUCLEAR INCIDENTS (REFERENCE MANUAL)

Recommended readings:

1. Conklin, W Craig; Liotta, Philip L.: RADIOLOGICAL THREAT ASSESSMENT AND THE FEDERAL RESPONSE PLAN—A GAP ANALYSIS; Health Physics: November 2005 - Volume 89 - Issue 5 - p 457-470, doi: 10.1097/01.HP.0000178546.37526.c8
2. Radim Vičar, Dušan VIČAR: CBRN TERRORISM: A CONTRIBUTION TO THE ANALYSIS OF RISKS; Journal of Defense Resources Management (JoDRM), 2/2011, pp. 21-28.

Responsible for course (name, position, scientific degree): Dr. József Csurgai PhD

Other teachers (name, position, scientific degree):

Title of the course: Mathematical methods of risk analysis	**Code:** HKDID4221A	**Credits:** 3
Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2		
Knowledge assessment (exam/academic grade): exam		
The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)		
Pre-subject requirements *(if any)*: Military Technology		
Course description: Basics of the Probability theory and Mathematical statistics. Technical systems fault tree, HAZOP, and event tree analysis. Basics of the fuzzy logic. **Educational goal of subject - Competencies:** To give a general overview about methods of the operational risk assesment, as well as make a basic knowledge of risk analysis and its mathematical modelling.		
Required readings: 1. Olav Kallenberg; Foundations of Modern Probability, 2nd ed. Springer Series in Statistics. (2002). 650 pp. ISBN 0-387-95313-2 2. Gut, Allan (2005). Probability: A Graduate Course. Springer-Verlag. ISBN 0-387-22833-0 **Recommended readings:** 1. http://en.wikipedia.org/wiki/Fuzzy_logic 2. http://en.wikipedia.org/wiki/Fault_tree_analysis		
Responsible for course (name, position, scientific degree): Dr. József Csurgai PhD		
Other teachers (name, position, scientific degree):		

Title of the course: Containerised wastewater treatment systems of military camps	**Code: HKDID4238A**	**Credits: 3**
Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): lecture 30 hrs / 10 hrs		
Knowledge assessment (exam/academic grade): exam		
The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)		
Pre-subject requirements *(if any)*: -		
Course description: Basics of wastewater treatment: pre-treatment, biological processes, chemical processes. Activated sludge and attached growth technologies. Membrane techniques. Containerised wastewater treatment, decentralized solutions. Small size treatment unit selection and operation. **Educational goal of subject - Competencies:** Ability of selection and operation of containerized treatment systems based on the basics of wastewater treatment		
Required readings: Metcalf & Eddy: Wastewater Engineering Treatment and Reuse McGraw-Hill, 2013 ISBN: 978-1259010798 **Recommended readings:** Grady et al: Biological Wastewater Treatment, IWA Publishing, 2018. ISBN: 978-1138582828		
Responsible for course (name, position, scientific degree): Tamas KARCHES, associate professor, PhD		
Other teachers (name, position, scientific degree):		

Title of the course: Organic micropollutants and environmental safety	**Code: HKDID4242A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 30 / 10 lectures

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: *none*

Course description:
Classification of organic micropollutants (OMPs), legal regulations. Occurrence, transport and fate of environmental pollutants in the environment. Environmental and health effects. General introduction to and main characteristics and effects of the major groups of OMPs. Analytical methods of detection. Preventing OMP discharge into the environment. Case studies.

Educational goal of subject - Competencies:
Students will be able to understand the potential consequences of OMPs on environmental safety. Students will get to know the various OMP groups as well as their adverse ecotoxicological and health effect. They will gain insight into the analytical methods to detect OMPs and methods for removal.

Required readings:
Calvo-Flores F.G., Isac-Garcia J., Dobado J.A: *Emerging Pollutants Origin, Structure and Properties*, 2018, Wiley-VCH
Knisz Judit: *Szerves mikroszennyezők a vizekben*, 2020

Recommended readings:
Wilkinson, J., et al., *Occurrence, fate and transformation of emerging contaminants in water: An overarching review of the field.* Environ Pollut, 2017. **231**(Pt 1): p. 954-970
Dinka, D.D., *Environmental Xenobiotics and Their Adverse Health Impacts-A General Review.* Journal of Environment Pollution and Human Health, 2018. **6**(3): p. 77-88.

Responsible for course (name, position, scientific degree): Judit Knisz, senior research scientist, PhD

Other teachers (name, position, scientific degree):

Title of the course: Soil conservation	**Code:** HKDID4243A	**Credits:** 3

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 20/6 hours / Seminar: 6/2 hours / Consultation: 4/2

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2nd - 4th. semester (depending on the individual educational program)

Pre-subject requirements *(if any)*: -

Course description:
The definition of soil and the characterisation of the main soil types in Hungary. Basics of soil conservation. Soil degradation processes: overview of water and wind erosion, structural degradation, natural and anthropogenic aciditation and the options for prevention. Characterisation of pollutants by source, damaged area and chemical composition. Effect of different pollutants on the biological activity of soil. Description of possible physical, chemical and biological remediation systems.

Educational goal of subject - Competencies:

The introduction of the main questions of soil conservation, furthermore, the possibilities of soil degradation prevention to the students. The effect of pollutants of different origins on the soil with special regard to the biological activity of the soil. After having completed the course successfully the students will be able to manage and solve soil conservation tasks and problems individually.

Required readings:
Duarte, A – Cachada, A - Rocha-Santos, T. (2017): Soil Pollution From Monitoring to Remediation ISBN: 9780128498736, Academic Press 312. p.

Recommended readings:
Helmut M (2013): Soil Remediation and Rehabilitation Treatment of Contaminated and Disturbed Land, ISBN 978-94-007-9822-9, Springer Netherlands, 408. p.
R. P. C. Morgan (2005):Soil Erosion And Conservation. ISBN 1-4051-1781-8, Blackwell Publishing, 304. p.
Miller M. E. – Bowker M. A. – Reynolds L. R. – Goldstein H. L. (2012): Post-Fire land treatments and wind erosion – Lessons from the Milford Flat Fire, UT, USA, Aeolian Research 7. pp. 29-44.
https://www.intechopen.com/books/soil-contamination/biological-remediation-of-hydrocarbon-and-heavy-metals-contaminated-soil

Responsible for course (name, position, scientific degree): Dr. Beke, Dóra, associate professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Hydrobiology	**Code: HKDID4244A**	**Credits:**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 1 lecture/week/semester

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: -

Course description:

During the course students will get acquainted with the basic hydrobiological terminology, methods, aquatic habitats, we will deal with the light climate of the waters, aquatic material cycling, the most important aquatic associations of aquatic organisms (aquatic regions: lithoral, pelagial etc., planktonic and benthic associations, organisms of the water bottom, aquatic vegetation). We review the four elements of biological water qualification (halobity, trophity, saprobity, toxicity) as well as the ecological status assessment required by the EU Water Framework Directive and the most important water types of Hungary.

Educational goal of subject - Competencies:

With this knowledge, they will be able to assess the importance of environmental disasters affecting surface waters to the aquatic ecosystem, to learn about the most important aquatic habitats and water types in Hungary, and can help to the policy makes good decisions to protect the aquatic environment. With their knowledge, they can help exchange information and experiences between water engineers and ecologists in order to prevent disasters or to make managements and interventions to reduce potential damage more effective.

Required readings: Robert Wetzel (2001): Limnology. Academic Press pp. 1006, ISBN: 9780127447605, eBook ISBN: 9780080574394

Recommended readings: Keddy P.A. (2010): Wetland Ecology Principles and Conservation, Cambridge University Press

Allan J.D. Castillo M.M., (2011) Stream Ecology: Structure and function of running waters, Springer Netherlands,

Responsible for course (name, position, scientific degree): Dr. Éva Ács, Research Professor, DSc

Other teachers (name, position, scientific degree):

Title of the course: Industrial pollution prevention	**Code: HKDID4246A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **30/10**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4.

Pre-subject requirements *(if any)*: none

Course description:

Students will gain general theoretical and practical knowledge of the international and domestic environmental safety regulations for the prevention of pollutant emissions from industrial facilities and the management of hazardous waste, its legal institutions and the order of official procedures.

Topics to be covered:

1. International and domestic regulation of industrial pollution prevention.
2. Integrated pollution prevention procedure and tools.
3. System of environmental permit procedures. Operator and authority tasks.
4. Impacts and reduction options of air, soil and water pollution.
5. Environmental response planning.
6. Activities of operators and authorities in the field of hazardous waste disposal.

Competences:

Students are introduced to international and national legislation related to the protection against major accidents involving dangerous materials; environment safety procedures of the operator and the authority as well as the methods of risk analyses supporting them.

The course acquaints students with the procedures of inspection of safety documents in dangerous establishments, with special regard to the inspection procedures of risk analysis as well as external safety plans and public information.

Required readings:

1. Mannan, S. Lees' Loss Prevention in the Process Industries: Hazard Identification, Management and Control; Butterworth-Heinemann: Kidlington, Oxford, UK, 2012; p. 3776.

Recommended readings:

1. Kátai-Urbán, Irina Assessment of the Industrial Safety Vulnerability of Settlements. BOLYAI SZEMLE 27 : 2 pp. 38-53. , 16 p. (2018)
2. Kátai-Urbán, Irina ; Vass, Gyula: Hazardous Activities in Hungary - in terms of Industrial Safety. ACADEMIC AND APPLIED RESEARCH IN MILITARY SCIENCE 13 : 1 pp. 141-154. , 14 p. (2014)

Responsible for course: Maj. Dr. Irina Kátai-Urbán, PhD

Other teachers: -

Title of the course: Air purity protection	**Code:** HKDID4401A	**Credits:** 2

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 14/4 hours / Seminar: 4/1 hours / Consultation: 2/1

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Overview of air contamination sources and chemicals. Steps of pollution spreading (emission, transmission, immission). Effects of air pollution, human impacts. Possibilities of reduction of air pollution.

Educational goal of subject - Competencies:
To give overview on the air pollution processes, and also knowledge on the proper evaluation, the assesment of air pollution consequences of different industrial and other activities.

Required readings:

1. Ronald E. Hester, Roy M. Harrison: Air Quality Management, Royal Society of Chemistry, 1997. ISBN 978-085-4042-3-57.
2. Donald W. Moffat: Handbook of Indoor Air Quality Management, Prentice Hall, 1997. ISBN 978-013-2353-0-07.

Recommended readings:

1. Arnold W. Jr. Reitze, "Air Quality Protection Using State Implementation Plans - Thirty-Seven Years of Increasing Complexity," Villanova Environmental Law Journal 15, no. 2 (2004): 209-366
2. Air quality guidelines: Global update 2005, World Health Organization, UNAIDS – 2006. p. 485, ISBN 92 890 21926

Responsible for course (name, position, scientific degree): Prof. László Földi, PhD

Other teachers (name, position, scientific degree):

Title of the course: Waste handling and waste management	**Code:** HKDID4405A	**Credits:** 2

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 14/4 hours / Seminar: 4/1 hours / Consultation: 2/1

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Definition and categories of wastes. Possibilities of waste reduction. Principles of waste utilization. Industrial and communal wastes. Hazardous wastes. Waste disposal technologies. Collection and recycling of selected wastes. Incineration and deposition of hazardous wastes.

Educational goal of subject - Competencies:
To give overview on the different types of wastes and the ways of their proper handling, Also bring knowledge on the up-to-date waste management, 3-R (reduce, reuse, recycle). Give competency for problem solving of institutional and workplace waste management.

Required readings:

1. Jacqueline Vaughn: Waste Management: A Reference Handbook, ABC-CLIO, 2009. ISBN 978-159-8841-5-03
2. Act CLXXXV./2012. on waste management (26th November 2012.)

Recommended readings:

1. A.J. Morrisseya, J. Browneb: Waste management models and their application to sustainable waste management, https://ac.els-cdn.com/S0956053X03001818/1-s2.0-S0956053X03001818-main.pdf?_tid=c6951d0b-f7d1-4bda-8b01-469c1aaa7416&acdnat=1526465693_83b28816062ea98eab8bad5df793e11c
2. L. Giusti: A review of waste management practices and their impact on human health, https://ac.els-cdn.com/S0956053X09001275/1-s2.0-S0956053X09001275-main.pdf?_tid=72183dfc-bd8b-40c0-8385-1526349d274d&acdnat=1526465778_8137a18209c78bfeee64294abe8bea18

Responsible for course (name, position, scientific degree): Prof. dr. László Földi, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Turbulent diffusion of air pollutants	**Code:** HKDID4406A	**Credits:** 2

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 16/4 hours / Seminar: 2/1 hours / Consultation: 2/1

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: Military Technology

Course description:

1. Emission source term models
2. Atmospheric dispersion models
    a. Gaussian dispersion model
    b. Lagrangian dispersion model
    c. Eulerian dispersions model
    d. Dense gas model
3. Release and spread of Toxic Industrial Materials (TIM) during accidents
4. Meteorological conditions for spreading. Air stability, atmospheric models, using meteodata for prediction of spread.
5. Prediction procedures and monitoring systems for spreading air pollutants
6. Using softwares for atmospheric dispersion modelling

Educational goal of subject - Competencies:

To give a general overview about emission, transmission and immission of air pollutants paying attention to heavy gases, toxic and radioactive materials.

Recommended readings:

1. Földi László, Halász László: Környezetbiztonság, Complex Kiadó, 2009 Budapest, p 419, ISBN: 978-963-295-020-4
2. Dr. Halász László, Dr. Földi László: Környezetvédelem II, ZMNE Elektronikus egyetemi jegyzet, Budapest, 2008.
3. József Csurgai, János Zelenák, Árpád Vincze, József Solymosi, István Goricsán, László Halász, Tamás Lajos, István Pintér: Numerical simulation of transmission of NBC materials (Military technology, 2005/1. pp. 13-19)
4. József Csurgai, János Zelenák, Tamás Lajos, István Goricsán, László Halász, Árpád Vincze, József Solymosi: Numerical simulation of transmission of NBC materials, Academic and Applied Research in Military Science, Vol 5 (2006), Issue 3, pp. 414-437
5. József Csurgai: Analysis of relationship of nuclear disaster relief and chemical catastrophes (PhD dissertation, 2003)
6. János Zelenák: Further development of estimating procedures of the chemical and radiological situation analysis (PhD dissertation, 2010)

Responsible for course (name, position, scientific degree): Prof. Dr. László Halász DSc

Other teachers (name, position, scientific degree): Dr. József Csurgai PhD

Title of the course: Evaluation of NBC and fire situations	**Code:** HKDID4421A	**Credits:** 2

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 16/4 hours / Seminar: 2/1 hours / Consultation: 2/1

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: Military Technology

Course description:
Warning and reporting and hazard prediction of chemical, biological, radiological and nuclear incidents. Physical and chemical foundations of emission, transmission and immission of the toxic chemicals and radioactive materials. Consequences of serious incidents, accidents (Tokyo Sarin Attack, Chernobyl, Tokai Mura, Enschede, AZF Toluouse, Fukusima). Functional structure and operational principals of the CBRN Warning and Reporting System and Hungarian disaster relief system.

Educational goal of subject - Competencies:
To give a general overview for implementation and investigation of the procedures of the CBRN Warning and Reporting System.

Recommended readings:

1. ATP-45(D) WARNING AND REPORTING AND HAZARD PREDICTION OF CHEMICAL, BIOLOGICAL, RADIOLOGICAL AND NUCLEAR INCIDENTS (OPERATORS MANUAL)
2. AEP-45(C) WARNING AND REPORTING AND HAZARD PREDICTION OF CHEMICAL, BIOLOGICAL, RADIOLOGICAL AND NUCLEAR INCIDENTS (REFERENCE MANUAL)

Responsible for course (name, position, scientific degree): Dr. József Csurgai PhD

Other teachers (name, position, scientific degree):

Title of the course: Climate change, climate extremes	**Code: HKDID4439A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture - **/ Seminar: 20/6 hours** / Consultation: -

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*:

Course description:

Weather and climate, global warming, climate change. Basics of the statistical climatology, distributions of the meteorological parameters, statistics of extremes. Observed and projected tendencies, averages and extremes in Hungary based on measured data and regional climate model predictions. Effects of climate extremes to military activities.

Educational goal of subject - Competencies:

To give a general overview for climate, global warming, climate change and statistics of extremes. To introduce climatic data analysis by statistical methods, to give knowledge about statistical features (averages and extremes, return levels and periods, extreme value thresholds, indices). With a changing climate which issues in change of the distribution of meteorological parameters, might also change frequencies and intensity of extremes. This knowledge can help to adapt to effects of climate change and mitigate vulnerability of different military activities.

A **3-5** legfontosabb *kötelező,* illetve *ajánlott* **irodalom** (jegyzet, tankönyv) felsorolása bibliográfiai adatokkal (szerző, cím, kiadás adatai, oldalak, ISBN)

Required readings:

1. IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.
2. IPCC, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

Recommended readings:

3. Amir AghaKouchak et al. (szerk), 2013: Extremes in a Changing Climate. Detection, Analysis and Uncertainty. Water Science and Technology Library,

Vol. 65, Springer Dordrecht Heidelberg New York London, 423 pp., ISBN 978-94-007-4478-3, ISBN 978-94-007-4479-0 (eBook)
4. László Földes, József Padányi (ed.), 2014: Effects of climate change to military activities. National University of Public Service. 270 pp. ISBN 9786155305252
5. Mónika Lakatos et al., 2020: Return values of 60-minute extreme rainfall for Hungary. IDŐJÁRÁS Quarterly Journal of the Hungarian Meteorological Service, Vol. 124, No. 2, April – June, 2020, pp. 143–156 (https://met.hu/ismeret-tar/kiadvanyok/idojaras/)
6. Csilla Péliné Németh et al., 2016: Analysis of climate change influences on the wind characteristics in Hungary. IDŐJÁRÁS Quarterly Journal of the Hungarian Meteorological Service Vol. 120, No. 1, January – March, 2016, pp. 53–71

Responsible for course (name, position, scientific degree): Csilla Péliné dr. Németh, PhD.

Other teachers (name, position, scientific degree)

Title of the course: Microbiologically influenced corrosion and implications on environmental safety	**Code: HKDID4440A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 2 lectures

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: *none*

Course description:

Basics of corrosion and microbiology. A general introduction to microbially influenced corrosion (MIC). Mechanisms of MIC. MIC risk assessment. Tools for identification of MIC, diagnostic methods, typical errors during diagnosis. Methods of prevention and treatment of MIC, monitoring options. Presentation of the main sectors affected by MIC (oil industry, energy sector, fire spriknler systems, fighter aircraft, drinking water distribution systems, etc.), environmental safety aspects. Case studies.

Educational goal of subject - Competencies:

Participants will be able to understand the developmental process of MIC and recognize environmental conditions supporting the development of MIC as well its implications on environmental safety. Participants will be able to take measures in preventing and mitigating MIC.

Required readings:

Eckert, RB and Skovhus, TL (2022). *Failure Analysis of Microbiologically Influenced Corrosion* (CRC Press).

Ru Jia, Tuba Unsal, Dake Xu, Yassir Lekbach, Tingyue Gu,: Microbiologically influenced corrosion and current mitigation strategies: A state of the art review, International Biodeterioration & Biodegradation, Volume 137,2019,Pages 42-58

Recommended readings:

Brenda J. Little, Jason S. Lee: Microbiologically Influenced Corrosion, Wiley, 2007

Responsible for course (name, position, scientific degree): Judit Knisz, senior research scientist, PhD

Other teachers (name, position, scientific degree):

Title of the course: Modeling and Optimization of Logistics Networks	**Code: HKDID5219A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): lecture, 30/10

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Basic definitions in graph theory: node, edge, loop, multiple edges, degree, walk, trail, path, tour (Bridges of Königsberg), clique, directing, weighting, connected graph, component, tree, leaf, root, forest, (minimum) spanning tree, complete graph, complement graph, isomorphism, dual graph. Applications in logistics.
Shortest path algoritms. Applications on minimizing path length, time and cost. Limitations of greedy algorithms.
Flow. Max-flow min-cut theorem. Capacity and rerouting. Application on the travelling salesman problem and the assignment problem.
Cluster analysis. Hierarchical (agglomerative and divisive) and non-hierarchical (centroid-based and density-based) clustering. Spreading phenomena. The butterfly effect. Cascades. Chaos.
Random networks, robustness, scale-free networks. Degree-correlation. Random failure and targeted attack. Vulnerability and resilience. Application on critical infrastructure. Entanglement.
Problems of modeling: accuracy (data, results), conditions, approximations, simplifications, second-order approximation, interpreting the results, decomposing and simplifying the results, solvability.

Educational goal of subject - Competencies:
The student knows to use graph theory to describe and model networks with different structure, with special attention to critical infrastructures. They are able to recognize the imortant network elements and to identify them using mathematical and computational methods. They know and handle the inaccuracies of models originating in approximations and simplifications and their effect on the results of the model used.

Required readings:
Albert-László Barabási: Network Science. http://networksciencebook.com/

Recommended readings:
Wayne L. Winston: Operations Research Applications and Algorithms, Brooks/Cole Thomson Learning, Belmont, CA, USA, 2003. ISBN 9780534380588
Erik Jenelius: Redundancy importance: Links as rerouting alternatives during road network disruptions, *Procedia Engineering* 3, pp. 129-137 (2010), DOI: 10.1016/j.proeng.2010.07.013

Responsible for course (name, position, scientific degree): Dr. Bence TÓTH, habil. senior lecturer, PhD

Other teachers (name, position, scientific degree):

Title of the course: Numerical Solution of Logistics Problems	**Code: HKDID5220A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): lecture, 30/10

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
The knapsack problem and its applications. Modeling bottlenecks.
The change-making problem. The limitations of greedy algorithms.
The facility location problem. Simultaneous minimization and maximization of various parameters.
Scheduling. Single machine and job shop scheduling.
Hyperbolic programming problems. Sensitivity analysis.
Forecasting models. Moving-average, exponential smoothing, seasonality, regression.
Approximation methods: least squares. Random numbers, Monte Carlo simulation.
Queuing. Probability distributions, memoryless property. Single, finite number and infinite number of servers. Arrival processes and service times of Markovian, degenerate and general distributions.
Problems of modeling: accuracy (data, results), conditions, approximations, simplifications, second-order approximation, interpreting the results, decomposing and simplifying the results, solvability.

Educational goal of subject - Competencies:
The student knows some simple operations research problems, their solution methods and their applications in military logistics. They are able to recognize the important elements in the problems and to apply proper mathematical and computational methods in solving them. They know and handle the inaccuracies of models originating in approximations and simplifications and their effect on the results of the model used.

Required readings:
Albert-László Barabási: Network Science. http://networksciencebook.com/

Recommended readings:
Wayne L. Winston: Operations Research Applications and Algorithms, Brooks/Cole Thomson Learning, Belmont, CA, USA, 2003. ISBN 9780534380588
Erik Jenelius: Redundancy importance: Links as rerouting alternatives during road network disruptions, *Procedia Engineering* 3, pp. 129-137 (2010), DOI: 10.1016/j.proeng.2010.07.013

Responsible for course (name, position, scientific degree): Dr. Bence TÓTH, habil. senior lecturer, PhD

Other teachers (name, position, scientific degree):

Course's name: Case Studies in Logistics	**Code: HKDID 5224A**	**Credits: 3**

Type of the course: **lecture** / seminar / class work / consultation and the number: **lecture: 2 h …….Seminar:** ….. h

Method of evaluation (**colloquium** / seminar grade / other): colloquium

Course's place in the curriculum (which semester): 3.

Preliminary course conditions *(if exists)*: **no**

Course description: acquiring the knowledge and competences to be developed in a short, informational way: Examining and processing case studies connected to logistics and supply chain management provide a good opportunity to the understanding of logistical processes and operational mechanisms of supply chain by combining literature and practice. Processing case studies can take place by inviting professionals who share their experiences, or by solving cases.

Fields of study:

1. Methods of solving case studies.

2-3. Processing case studies. (Logistics in economy)

4-5. Processing case studies. (Inventory - storage)

6-7. Processing case studies. (Materials management)

8-9. Processing case studies. (Material handling, transportation)

10-11. Processing case studies. (Supply chains, cooperation)

12-13. Processing case studies. (Uncertainties in the supply chains)

14-15. Conclusion of knowledge and experiences.

Competences: Aim is to develop thinking at systematical level. Acquiring routine in identifying logistical and professional problems and in working out solutions and ideas.

The **3-5** most important *compulsory* literature, and *advised* literature (author, address, data of publication, pages, ISBN)

Compulsory literature:

- Horváth Attila: Az ellátási lánc, mint kritikus infrastruktúra (létfontosságú rendszerelem). In: Csengeri, János; Krajnc, Zoltán (szerk.) Humánvédelem - békeműveleti és veszélyhelyzet-kezelési eljárások fejlesztése Budapest, Magyarország : Nemzeti Közszolgálati Egyetem, Hadtudományi és Honvédtisztképző Kar, (2016) pp. 550-614. URL cím: http://real.mtak.hu/33554/1/tanulmanygyujtemeny%20_ujratervezes_CsJ_KZ_1.5.pdf
- Hegedűs Ernő – Turcsányi Károly: Vasúti szállítás kontra tengeri szállítás: a Madrid Jivu vasútvonal logisztikai és biztonságpolitikai szerepe: - szállítási ágak, közlekedés stratégia vizsgálata, Katonai Logisztika 2018:3-4 pp. 241-272.
- Keszthelyi Gyula: Ellátási lánc menedzsment és logisztika kapcsolatrendszere, élettartam,-költségmenedzsment, Katonai logisztika, 2018:1, pp.42-71.
- Szegedi Zoltán: Logisztika - menedzsment esettanulmányok, Kossuth Kiadó, Budapest, 2008

Advised literature:

- Szegedi Zoltán: Case Studies to Logistics Management, Kossuth Kiadó, Budapest, 2008 (angol nyelvű esettanulmányok)
- Padányi József: The Significance of Civil-military Cooperation in Missions and Preparation in Crisis Aerials. in Újházi Lóránd; Kaló József; Petruska Ferenc (szerk) Budapest Report On Christian Persecution, 2019. Budapest Háttér Kiadó, pp. 15-24.

Notes:

Responsible tutor: (*Pató Gáborné Szűcs Beáta, associate professor, Ph.D., habil*.**)**
Tutors involved in the course, if there exist (*name, status, academic degree)*

Note: max. 1 page

Title of the course: Supply Chain Designing and Security	**Code: HKDID5407A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **20/6**

Knowledge assessment (exam/academic grade): **academic grade**

Knowledge assessment (exam/academic grade): 2-4.

Pre-subject requirements *(if any)*: none

Subject Objectives:

Subject develops student´s ability to identify, describe and analyse the design and operation of the supply chains and logistics workflow of under the conditions of uncertainty. There are identified the ties and dependence of multinational military logistics on the capabilities of civil entities and critical logistics infrastructure, especially from the point of view of supply chain security and long-term sustainability. The international and national points of views are discussed Subject enhance the supply chain theory and methodology of projecting and management of logistics processes, together with the security and sustainability aspects. For successful fulfilment subject´s task is appropriate prerequisites of understanding of the principles of military and civilian logistics, knowledge of project management and stochastic approaches is advantage. In the beginning of the subject, there is initial session with lecturer and discussion on the current influencing factors directly or indirectly influencing the military logistics chains, under the conditions of uncertainty. Then follows the main part of subject which is preparation of analytical study focused on selected part of supply chain with evaluation of influencing factors and preparation recommendation for enhancing the supply chain design and overall long-term sustainability.

Subject Completion:

The main part of the subject is laid on the preparation of the study in the length up to 20 pages. The subjects end with the evaluation and following expert discussion based on the study and its results.

Required readings:

1. KOTZAB, H.; SEURING, S.; MÜLLER, M.; REINER, G. *Research Methodologies in Supply Chain Management.* New York: Physical-Verlag Heilderberg, 2005. ISBN 3-7908-1583-7. 619 pp.
2. WATERS, D. *Supply Chain Risk Management – Vulnerability and Resilience in Logistics*. London: Kogan Page Limited, 2007. ISBN 978-0-7494-4854-7. 256 pp.
3. FELLMAN, P.; BAR-YAM, Y.; MINAI, A. *Conflicts and Complexity – Countering Terrorism, Insurgency, Ethnic and Regional Violence.* New York: Springer Science+Business Media, 2015. ISBN 978-1-4939-1705-1. 292 pp.
4. TANG, C.; TEO, C-P.; WEI, K-K. *Supply Chain Analysis – Handbook on the Interaction of Information, System and Optimization.* New York: Springer Science+Business Media, 2008. ISBN 978-0-387-75239-6. 284 pp.

Recommended readings:

1. SIMCHI-LEVI, D.; WU, D.; SHEN, Z. *Handbook of Quantitative Supply Chain Analysis – Modelling in the E-Business Era.* New York: Springer Science+Business Media, 2004. ISBN 1-4020-7953-2.
2. ROBINSON, Stewrt. *Simulation*. Chichester: John Wiley, 2004, 339 s. ISBN 0-470-84772-7.

Responsible for course:

Col (GS) Dr. habil. Ing. Pavel Foltin, Ph.D.; University teacher/Head of Department of Logistics, Faculty of Military Leadership, University of Defence

Other teachers: -

Title of the course: Network Analysis of Critical Infrastructures	**Code: HKDID5412A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): seminar, 20/6

Knowledge assessment (exam/academic grade): academic grade

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Basic definitions in graph theory.
Graph-theory based modeling of critical infrastructures. Weigting and directing.
Quantitative analysis and comparison of networks both on the global and local range. Opportunities and limitations of shortest path finding algorithms. Centrality measures.
Determining capacity: flow and cut.
Redundancy measures. Identifying redundant elements of a network. Handling 1-edge-connected and 1-vertex-connected networks. Connection between traffic and redundancy. Inclusion and evaluation of redundancy in the view of the security of the network.
Robustness of networks. Identifying random, small world and scale-free networks based on their behaviour in the case of random failure and targeted attack.
Problems of modeling: accuracy (data, results), conditions, approximations, simplifications, second-order approximation, interpreting the results, decomposing and simplifying the results, solvability.

Educational goal of subject - Competencies:
The student knows the basic definitions of graph theory and its various applications in describing critical infrastructures with different types and strucures, as networks. They are able to apply measures used in describing networks in identifying critical network elements. They know the methods of identifying redundant network elements and their difficulties and can apply them in describing the safety of networks. They are able to forecast anomalies of critical infrastructures appearing in the case of disruption by the analysis of the robustness of the network. They know and handle the inaccuracies of models originating in approximations and simplifications and their effect on the results of the model used.

Required readings:
Albert-László Barabási: Network Science. http://networksciencebook.com/

Recommended readings:
Wayne L. Winston: Operations Research Applications and Algorithms, Brooks/Cole Thomson Learning, Belmont, CA, USA, 2003. ISBN 9780534380588
Erik Jenelius: Redundancy importance: Links as rerouting alternatives during road network disruptions, *Procedia Engineering* 3, pp. 129-137 (2010), DOI: 10.1016/j.proeng.2010.07.013

Responsible for course (name, position, scientific degree): Dr. Bence TÓTH, habil. senior lecturer, PhD

Other teachers (name, position, scientific degree):

Title of the course: Applied statistics	**Code: HKDID6212A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 30 h./10 h.

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester

Pre-subject requirements *(if any)*: none

Course description:

This course aim is that students acqiure an active knowledge of the basics of probability theory and get skills in its application to the methods in applied statistics. The topics are: Probability theory basics: Postulates of probability theory. Expected values and their properties. The law of large numbers. Probability distributions: i.e. binomial, Poisson distribution, exponential and normal distribution. The Poisson process. Chi-squared, Student distributions. Sampling methods. Statistical analysis. Estimation methods: maximum likelihood, least squares. Properties of estimators. Confidence intervals. Hypothesis testing.

Educational goal of subject - Competencies:

To give a general overview about the concepts of applied statistics, as well as its mathematical background.

Required readings:

1. W. H. Press et al.: Numerical Recipes, The Art of Scientific Computing, Cambridge University Press, 1986 C.
2. J. R. Green, D. Margerison: Statistical Treatment of Experimental Data, Elsevier, 1978
3. Reimann, Tóth: Valószínűségszámítás és matematikai statisztika, Budapest, 2004.

Recommended readings:

1. William Feller: An Introduction to Probability Theory and its Application, John Wiley, 1971
2. Bolla Marianna, Krámli András: Statisztikai következtetések elmélete, Typotex Kiadó, Budapest, 2005.
3. Rényi: Valószínűségszámítás. Tankönyvkiadó. Budapest, 1968.
4. Chatfield, A. J. Collins: Introduction to Multivariate Analysis, Chapman and Hall, 1980

Responsible for course (name, position, scientific degree): Dr. István Horváth, professor, DSc

Other teachers (name, position, scientific degree): –

Title of the course: Fire Dynamics I.	**Code: HKDID6424A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lectures and laboratory sessions 20 h (full time)/ 6 h (part-time)

Knowledge assessment (exam/academic grade): exam (written and oral)

The course place in the curricula (in which semester): 2nd semester

Pre-subject requirements *(if any)*: Basic knowledge in physics, mathematics and chemistry

Course description:

Fire Dynamics I. is aimed to help students understand the basic development of fire in an enclosure along with determination of heat flows and flame heights. Additionally, the students will be able to calculate pressure difference caused due to room fires, plume mass flow rates, temperature of hot layer, density differences, etc. Besides the enclosure fires students have get information about the open fires focusing mostly on forest fires to understand the development and variability of its, depending on the different environmental condition.

Educational goal of subject - Competencies:

The student will have competencies regarding fire behaviour in an enclosure and calculate various aspects of it such as temperature, pressure, density, etc. at basic level. The students will be well versed in mass and energy balance and basic thermodynamics. Besides the above students will understand both the basic elements of wildland fires development and the required conditions of its changes.

Required readings:

1. Karlsson, B., Quintiere, J., G. (2000) Enclosure Fire Dynamics and learning materials provided by the teacher(s). eBook ISBN9780429122675 DOI:10.1201/9781420050219

Recommended readings:

1. Martin Gillie, Yong Wang (2017) Applications of Fire Engineering, eBook ISBN9781315107202, DOI:10.1201/9781315107202
2. Andrew Buchanan, Birgit Östman (2022) Fire Safe Use of Wood in Buildings, eBook ISBN9781003190318, DOI:10.1201/9781003190318

Responsible for course (name, position, scientific degree):

- Oisik Das, senior lecturer, PhD (New Zealand); M.S. (USA), B.Tech (India) Lulea University of Technology, Lulea, Sweden

Other teachers (name, position, scientific degree):

- Agoston Restas, associate professor, PhD, University of Public Service, Budapest, Hungary

Title of the course: Fire Dynamics II.	Code: HKDID6425A	Credits: 2

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lectures and seminars (laboratory sessions). 20 h (full time), 6 h (part-time)

Knowledge assessment (exam/academic grade): exam (written and oral)

The course place in the curricula (in which semester): 3rd semester

Pre-subject requirements *(if any)*: Specialised knowledge as acquired from Fire Dynamics I.

Course description:

Course of Fire Dynamics II is based on the knowledge of Fire Dynamics I. and it is aimed to help students understand the development of fire in an enclosure along with determination of heat flows and flame heights at advanced level. Additionally, the students will be able to calculate pressure difference caused due to room fires, plume mass flow rates, temperature of hot layer, density differences, etc. Students will have knowledge about fire detection and ventilation as well as CFAST simulation. Additionally, students have get advanced information about open fires, mostly focusing on forest fires, its development in extreme conditions and required resources to suppress it.

Educational goal of subject - **Competencies:** The student will have competencies regarding fire behaviour in an enclosure and calculate various aspects of it such as temperature, pressure, density, etc. at advanced level. The students will be well versed in mass and energy balance and basic thermodynamics. Additionally, students have understand the development of large scale wildland fires and calculate the theoretical forms of burned area.

Required readings:

2. Karlsson, B., Quintiere, J., G. (2000) Enclosure Fire Dynamics and learning materials provided by the teacher(s). eBook ISBN9780429122675 DOI:10.1201/9781420050219

Recommended readings:

3. Martin Gillie, Yong Wang (2017) Applications of Fire Engineering, eBook ISBN9781315107202, DOI:10.1201/9781315107202
4. Andrew Buchanan, Birgit Östman (2022) Fire Safe Use of Wood in Buildings, eBook ISBN9781003190318, DOI:10.1201/9781003190318

Responsible for course (name, position, scientific degree):

- Oisik Das, senior lecturer, PhD (New Zealand); M.S. (USA), B.Tech (India) Lulea University of Technology, Lulea, Sweden

Other teachers (name, position, scientific degree):

- Agoston Restas, associate professor, PhD, University of Public Service, Budapest, Hungary

Title of the course: Management of Industrial safety	**Code: HKDID7109A**	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 60/20 hours

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4.

Pre-subject requirements *(if any)*: none

Course description:

1. The basics of the management of industrial safety. Prevention of man-made disasters. Definitions and criteria.
2. Fields, organisation and system of procedures of industrial safety.
3. Tasks of the operator, authority and local government related to industrial safety; system of measures of prevention and preparation.
4. Applying and reviewing systems (standards) for work health and safety and environmental management.
5. International, EU and national legislation related to the protection against major accidents involving dangerous materials.
6. Industrial safety tasks of regulation related to the resilience of critical entities.
7. Prevention of nuclear accidents and related industrial safety tasks.

Education goal of subject - Competences:

Students become acquainted with the general and specific strategic and tactical principles, legal regulation, organisation of industrial safety management as well as its procedures and equipment for preparation and prevention of industrial disasters and accidents.

Required readings:

1. Fairman; Mead; Williems: Environmental Risk Assessment. Monitoring and Assessment Research Centre, King's College London; ISBN 92-9167-080-4
2. Kátai-Urbán Lajos: Handbook for the Implementation of the Basic Tasks of the Hungarian Regulation on „Industrial Safety" Budapest: Nemzeti Közszolgálati Egyetem, 2014. 73 p. (ISBN 978-615-5491-70-2)
3. Kátai-Urbán L.: Establisment and Operation of the System for Industrial Safety within the Hungarian Disaster Management. ECOTERRA: JOURNAL OF ENVIRONMENTAL RESEARCH AND PROTECTION (ISSN: 1584-7071) 11: (2) pp. 27-45. (2014)
4. Lajos Kátai-Urbán; József Solymosi: Overview of consequence modelling in process industry, ACADEMIC AND APPLIED RESEARCH IN MILITARY SCIENCE (ISSN: 1588-8789) 3: pp. 407-416. (2006)
5. Kátai-Urbán Lajos: Safety of Hazardous Plants, Semmelweis Publishing House Budapest, 2025. (ISBN: 978-963-331-650-4)

Recommended readings:

1. Kátai-Urbán, Lajos; Vass, Gyula; Sibalinné Fekete Katalin: Establishment and Implementation of Hungarian System for Critical Infrastructure Protection. pp. 353-360. (2014) In.: 19. medzinárodná vedecká konferencia Riešenie krízových situácií v špecifickom prostredí. Konferencia helye, ideje: Zilina, Szlovákia:

2014.05.21-2014.05.22. (ISBN 978-80-554-0872-9) A konferencia szervezője: Fakulta špeciálneho inžinierstva ŽU

2. Kátai-Urbán Lajos, Révai Róbert: Possible Effects of Disasters Involving Dangerous Substances Harmful to the Environment, Human Life and Health: A veszélyes anyagokkal kapcsolatos katasztrófák lehetséges környezetet, emberi életet és egészséget károsító hatásai. BOLYAI SZEMLE XXII.:(2) pp. 151-158. (2013)
3. Horváth Hermina, Kátai-Urbán Lajos: Assessment of the Implementation Practice of Emergency Planning Regulations Dedicated to the Rail Transportation of Dangerous Goods. ACADEMIC AND APPLIED RESEARCH IN MILITARY SCIENCE 12:(1) pp. 73-82. (2013)

Notes: -

Responsible for course:
COL. Dr. Gyula Vass PhD, associate professor

Other teachers:
COL. Dr. Lajos Kátai-Urbán PhD, associate professor

Title of the course: Disaster management	**Code:** HKDID7110A	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): Lecture 40/12 hours / Seminar: 12/4 hours / Consultation: 8/4 hours

60/20 hours

Knowledge assessment (exam/academic grade): oral comprehensive exam

The course place in the curricula (in which semester):
2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

- Fire prevention, civil protection and industrial safety basics, tasks and tools for disaster prevention
- Regulatory tasks, integrated activities of public authorities, regulation, changes
- Fire protection in the disaster management system, official activities
- Prevention, official tasks and objectives of civil protection
- Rules for the classification of municipalities in disaster management and protection requirements (risk identification, risk analysis and assessment)
- Tasks of industrial safety
- Protection against major accidents involving dangerous substances
- Transport of dangerous goods (ADR, RID, ADN, ICAO/IATA)
- Organisation and management of disaster management (Parliament, Periods of special legislation, Functions of the Government, Minister responsible for disaster management)
- Structure and tasks of the county and local protection committee
- Management levels and professional bodies of professional disaster management bodies (The National Directorate General for Disaster Management, Definition and evaluation of the tasks of professional disaster management bodies, The regional body, the county disaster management directorate, Local bodies, Disaster Management Commands, Fire brigades, Voluntary fire-fighting associations)
- Other priority topics (Flood and Inland Water Hazards in Hungary, Earthquake Hazards in Hungary, The Monitoring and Public Alert System, The National Nuclear Accident Response System, Mobile Disaster Management Laboratories (MRL), Activities of the Disaster Management Radiation Detection Units (DRU))

Educational goal of subject - Competences:
The objective of the course is to provide a systematic knowledge of the types of natural and anthropogenic disasters occurring in Hungary, their analysis, and the theoretical and practical methods of risk assessment, damage management and consequence management. The course will help prepare students for a scientific understanding of emergencies and will complement the complex understanding of the activities of the Civil Protection.
The Disaster Management course is designed for the interpretation and study of natural and man-made incidents (accidents) in our country, the acquisition of the most important

theoretical and practical knowledge of the activities required to assess and eliminate disasters.
The overall aim of the subject is to provide doctoral students at the Military Engineering Doctoral School with a high level of scientifically sound knowledge of the subject area and to answer scientific questions that may serve to deepen and broaden their research topics.

Required readings:

- Dr. Muhoray Árpád: Katasztrófamegelőzés I., egyetemi jegyzet, Budapest, 2016, Kiadja: NKE Szolgáltató Nonprofit Kft., ISBN 978-615-5527-85-2

Recommended readings:

- Coppola, Damon P. (2020): Introduction to International Disaster Management. 4. kiadás. Elsevier, Amsterdam. 896 o. ISBN 978-0-12-817368-8 (nyomtatott), ISBN 978-0-12-817059-5 (e-könyv).
- Feldmann-Jensen, Shirley – Jensen, Steven J. – Slick, Jean (szerk.) (2024): Case Studies in Disaster Response. Disaster and Emergency Management: Case Studies in Adaptation and Innovation sorozat. 1. kiadás. Elsevier, Amsterdam. ISBN 978-0-12-809526-3 (nyomtatott), ISBN 978-0-12-809537-9 (e-könyv).
- Vallero, Daniel A. – Letcher, Trevor (2023): Unraveling Environmental Disasters. 2. kiadás. Elsevier, Amsterdam. ISBN 978-0-443-18651-6 (nyomtatott), ISBN 978-0-443-18652-3 (e-könyv).

Responsible for course (name, position, scientific degree):
Col(Ret.) József SOLYMOSI, DSc, Professor Emeritus

Other teachers (name, position, scientific degree): Dr. habil. József DOBOR, associate professor

Title of the course: Civil protection	**Code: HKDID7111A**	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **60/20**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4

Pre-subject requirements *(if any)*: none

Course description:

1. Civil protection regulations on the protection against disasters.
2. Coordination of the protection against disasters between the various sectors.
3. The national system of coordinated disaster response.
4. Disaster management mechanism assisting governance.
5. National, sectoral, regional and local tasks of civil protection.
6. Organisation of regional and local civil protection tasks. The interpretation of state of emergency in disaster management.
7. Government control over disaster management.
8. Ideas on the improvement of disaster management.

Competences:

Students get acquainted with and do research on the theoretical background of civil protection regulations on disaster management; on the coordination of the protection against disasters between the various sectors, with special regard to the Inter-ministerial Committee for the Coordination of Disaster Management (KKB).
Students gain deep knowledge and do research on the national system of coordinated disaster response; the disaster management mechanism assisting governance; the national, sectoral, regional and local tasks of civil protection; organisation of regional and local civil protection tasks; the interpretation of state of emergency in disaster management; government control over disaster management; ideas on the improvement of disaster management.

Required readings:

1. Endrődi István: The Place and Role of the Information System Civilhelp.hu in the Structure of Disaster Management and its Importance in the Execution of Civil Protection Tasks. In: NISPAcee (szerk.) Government vs. Governance in Central and Eastern Europe: From Pre-Weberianism to Neo-Weberianism? Presented Papers from the 22nd NISPAcee Annual Conference. Konferencia helye, ideje: Budapest, Magyarország, 2014.05.22-2014.05.24. Pozsony: NISPAcee, 2014. pp. 28-41.
2. Endrődi István, Teknős László: New possibilities of emergency communication and information in the protection phase of disaster management. *ACADEMIC AND APPLIED RESEARCH IN PUBLIC MANAGEMENT SCIENCE* 13**:**(2) *pp. 235-249.* (2014)
3. Endrődi István: European cooperation forum of civilian protection organizations. In: Robert Zupan, Ana Kuvezdic Divjak. 3 rd International Conference Crisis Management Days. Konferencia helye, ideje: Velika Gorica, Horvátország, 2010.05.27-2010.05.28. Velika Gorica: University of Applied Sciences, 2010. pp. 718-735.
   (ISBN:978-953-7716-07-3)

Recommended readings:

1. Insarag preparedness and response. INSARAG Guidelines. URL.: http://www.insarag.org/en/methodology/guidelines.html (Downloaded: 2015.05.15.

Notes: -

Responsible for course:
Dr. László Teknős assistant professor, PhD

Other teachers: **Ret. Col. István Endrődi, PhD**

Title of the course: Nuclear safety and events/accidents	**Code:** HKDID7112A	**Credits: 6**

Type of lessons (lecture/seminar/consultation) and learning hours (full time training/part time training): 60/20

Knowledge assessment (exam/academic grade): exam

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

The objective of the course is to provide students with a comprehensive, systemic knowledge of the physical and technical fundamentals of nuclear energy applications, and the principles, procedures and tools necessary to maintain the safety of nuclear installations and to respond effectively to accidents.

During the training, students:

1. learn the basic concepts of atomic energy, the physics of nuclear fission, the principles of reactor operation and the types of reactors;
2. learn about the safety standards, regulatory environment (national and international), and the operation of passive and active safety systems applicable to nuclear installations;
3. analyse the types of nuclear incidents and accidents, their sequence, consequences and lessons learned (e.g. Chernobyl, Fukushima);
4. gain an insight into the organisational and technical aspects of nuclear accident management, including radiation protection measures, public protection, decontamination and management of hazardous zones;
5. gain a detailed understanding of the nuclear safety systems, operational exercises, emergency preparedness and protection philosophies applied at the Paks NPP.

Educational goal of subject - Competencies:

The course adopts an interdisciplinary approach to nuclear safety, combining technical, physical, regulatory and disaster management knowledge, contributing to deepen the students' professional perspective and to provide a basis for future responsible decision-making in the field of critical infrastructure safety.

Required readings:

1. Pátzay György (2011): Atomenergetika és nukleáris technológia. Egyetemi tananyag. Typotex Kiadó, Budapest. ISBN 978-963-279-468-6.
2. Dobor, J., Kiss, N., & Pátzay, Gy. (2022). Radioaktív izotópok egészségügyi használata és lehetséges kockázatainak összefoglalása. Hadmérnök, 17(4), 101–112. https://folyoirat.ludovika.hu/index.php/hadmernok/article/view/6215/5296

   Kyne, D. (2017). Nuclear power plant emergencies in the USA: Managing risks, demographics and response. Springer. https://doi.org/10.1007/978-3-319-50343-1

Recommended readings:

1. Pátzay, Gy. (2014). A paksi atomerőmű radioaktív normálüzemű és üzemzavari hulladékoldatainak szelektív tisztítása. Hadmérnök, 9(1), 117–123.

2. Phillips, Brenda D., David M. Neal, and Gary R. Webb. Introduction to Emergency Management and Disaster Science. 3rd ed., Routledge, 2021. https://doi.org/10.4324/9781003021919

Responsible for course (name, position, scientific degree):
Prof. Em. György Pátzay, professor emeritus, PhD

Other teachers (name, position, scientific degree): Dr. Kristóf HORVÁTH PhD

Title of the course: Fire protection	**Code: HKDID7113A**	**Credits: 6**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **60/20**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

1. Concepts in fire protection within the unified disaster management administration.
2. The hierarchy of fire protection legislation, fields of regulation, rights and responsibilities.
3. The structure and operation of fire protection in Hungary.
4. Organising rescue operations, organising and performing fire interventions and technical rescue.
5. The tasks and competence of fire prevention, its structure and procedures.
6. Fire inspection and analysis of interventions.
7. The activities of Disaster Management Operations Unit.

Educational goal of subject - Competencies:

This course provides a comprehensive understanding of the concept of fire protection, its legislation, fields of regulation as well as the rights and responsibilities of participants in fire protection. Students develop an understanding about the rules of fire prevention and rescue operations, their tasks and competence, the system of organisations and instruments.

Students are introduced to fire inspection, analysis of interventions and the procedures, structure and instruments of Disaster Management Operations Unit.

Required readings:

1. Bodnár László, Restás Ágoston, Xu Qiang: Conceptual Approach of Measuring the Professional and Economic Effectiveness of Drone Applications Supporting Forest fire Management, PROCEDIA ENGINEERING 211: (2018) pp. 8-17.
2. Restás, Á.: An Approach for Measuring the Economical Efficiency of Aerial Fire Fighting Wildfire2011: The 5th International Wildland Fire Conference: Sun City, South Africa, 09-13.05.2011.
3. Restás Á.: A Model for Firefighting Managers Making Decisions in Emergencies Proceedings of the 11th Int'l Conf. on Naturalistic Decision Making Marseille, France, 21-24.05.2013.

Recommended readings:

1. Restás, Á.: Examples for Drone Applications Supporting Disaster Management, 10th ELSEDIMA conference, Cluj-Napoca, Romania, 2014.09.18-19.
2. Sonechkin, Vladimir ; Panasevich, Liudmila ; Bleszity, János: Условия взвихрения пыли в деревообрабатывающем помещении. POZHARY I

CHREZVYCHAJNYE SITUACII: PREDOTVRASHENIE LIKVIDACIA 1 pp. 53-57. , 5 p. (2018)
Responsible for course (name, position, scientific degree): **Professor emeritus Dr. Bleszity János, CSc.**
Other teachers (name, position, scientific degree): **Dr. habil. Restás Ágoston associate professor, Eng. PhD, PhD**

Title of the course: Safety of Dangerous Activities	**HKDID7115A**	**Credits: 6**
Place of the course: HHK KMDI doctorial education		
Type of lessons and learning hours: 60/20		
Knowledge assessment: exam		
The course place in the curricula (in which semester): 2-4		
Pre-subject requirements *(if any)*: none		

Course description:

The aim of the subject is that the students get to know the authoritative tasks and responsibilities laid down in disaster management legislation concerning the dangerous activities, technical requirements related to the performance of the tasks of business organizations and a set of technical tools to support implementation.

Course description:

1. Fundamentals of safety for dangerous activities.
2. Disaster management features of dangerous activities.
3. Identification and classification of dangerous activities.
4. Operational and regulatory technical requirements and equipment system for dangerous establishments.
5. Operational and regulatory technical requirements and equipment system for dangerous goods activities.
6. A set of technical tools to ensure the security of critical infrastructures.
7. Technical requirements and system of equipment for fire prevention of dangerous installations.
8. Technical support to water and water authorities.
9. Technical equipment system for the protection of dangerous military objects.

Competences: High level theoretical knowledge of the safety of dangerous activities, carrying out independent activities in connection with the organization, management and scientific tasks related to the relevant scientific field.

Required readings:

1) Fairman; Mead; Williems: Environmental Risk Assessment. Monitoring and Assessment Research Centre, King's College London; ISBN 92-9167-080-4
2) Kátai-Urbán Lajos: Handbook for the Implementation of the Basic Tasks of the Hungarian Regulation on „Industrial Safety" Budapest: Nemzeti Közszolgálati Egyetem, 2014. 73 p. (ISBN 978-615-5491-70-2)
3) Kátai-Urbán L.: Establisment and Operation of the System for Industrial Safety within the Hungarian Disaster Management. ECOTERRA: JOURNAL OF ENVIRONMENTAL RESEARCH AND PROTECTION (ISSN: 1584-7071) 11: (2) pp. 27-45. (2014)

Recommended readings:

1) Lajos, Kátai-Urbán: Assessment of the Authority Experiences Related to the Supervision of Dangerous Goods Transportation. HADMÉRNÖK XI : 4 pp. 91-101. , 11 p. (2016)

2) Kátai-Urbán, Lajos ; Vass, Gyula: Safety of Hungarian Dangerous Establisments - Review of the Industrial Safety's Authority. HADMÉRNÖK IX. : 1 pp. 88-95. , 8 p. (2014)
3) Bleszity, János ; Kátai-Urbán, Lajos: Assessment of the Development of Legal Regulation on the Protection of Major Accidents. MAGYAR RENDÉSZET XVI : 2 pp. 43-54. , 12 p. (2016)

Responsible for course: COL. Dr. habil. Lajos Kátai-Urbán PhD, associate professor

Other teachers: COL. Dr. habil. Gyula Vass PhD, associate professor

Title of the course: Applied Firefighting HKDID7116A	**Credits: 6**
Type of lessons and learning hours: 60/20	
Knowledge assessment: exam	
The course place in the curricula (in which semester): 2-4	
Pre-subject requirements *(if any)*: none	
Course description: The aim of the subject is that the students get to know the physical background of fire and fire elimination, the factors affecting the effectiveness of fire fighting in different types of fires, as well as the technical requirements and support of interventions.	
Course description: 1. Physics of fire 2. Physics of fire elimination 3. Practice of fire suppression, tactics of firefighting 4. Applied firefighting in different cases 5. Effective fire management.	
Competences: Students gain comprehensive knowledge of the physical background of fire burning, the theoretical basis of extinguishing and its practical implementation, and the tactics of firefighting. Students will learn about the forms of effective firefighting in different cases, what conditions must be provided for them, and how firefighting is conducted and managed.	
Requirements: The prerequisite for signing the semester is that the student must report on the theoretical knowledge in a closed-class thesis. The signature also requires participation in a full-time course of at least 75% of the time, correspondence training of at least 50% of the hours, and at least a satisfactory evaluation of the closed-ended thesis. The students report on the subject knowledge in the final exam.	
Required readings: 4) Restás, Á.: Physics of fire (English manuscript) 5) Restás, Á.: R-20F method: An Approach to measure the isolation effect of foam used fighting forest fires 6) Regulation of the operations, technical rescue and disaster response activities of disaster management. (6/2016. (IV.24.) BM OKF instruction, English version) 7) Dedicated articles of Védelem Tudomány and Katasztrófavédelem periodicals **Recommended readings:** 4) Restás, Á.: An Approach for Measuring the Economical Efficiency of Aerial Fire Fighting Wildfire2011: The 5th Intl' Wildland Fire Conference: 09-13.05.2011. 5) English articles of Védelem Tudomány periodical (2017–2020)	
Responsible for course: (Ret) Lt. Col. Dr. habil. Ágoston Restás PhD, PhD, associate professor	
Other teachers:	

Title of the course: Dangerous substances and response	**Code:** HKDID7217A	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **30/10**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

The aim of the presentation is to provide a scientific approach to the risk management options for hazardous substances and to review risk reduction methods and technologies. Due to the interdisciplinary nature of the topic, it covers chemical, biological, radiological and nuclear aspects. Particular emphasis will be placed on the classification of hazardous substances, their behaviour in the environment and the operational and tactical response to incidents.

1. Definitions and classification of dangerous substances (CLP, GHS, REACH)
2. Properties of dangerous substances (physical, chemical characterisation)
3. Effects of hazardous substances on the human body, Toxicology
4. Reduction of adverse effects of dangerous substances
5. options, tools and solutions for damage control
6. Identification of hazardous substances
7. Dispersion and exposure models

Educational goal of subject - Competencies:

Students will learn about hazardous substances and their characteristics, dispersion and exposure models, the role of computer simulation systems (ALOHA, CAMEO) in decision support, damage control strategies and technologies, and the management of special events.

Required readings:

3. Dobor, József - Barina, Balázs - Pátzay, György (2024). Civil Defence Review, Special Issue 16, 217-234, Available: https://mpvsz.hu/pv_szemlek/pvszemle2024/index.html; ISSN 1788-2168
4. Dobor, J., Kiss, N., & Pátzay, G. (2023). Military Engineer, 17(4), 101-112. https://doi.org/10.32567/hm.2022.4.7
5. Móritz, S., & Dobor, J. (2024). Summary of potential risks of hazardous chemicals used in agriculture in Hungary. Technical Military Journal, 34(2). https://orcid.org/0009-0004-8484-3837
6. Pátzay György - Dobor József (2016): Hazards from industrial activities and their prevention. e-note, Budapest: NKE Szolgáltató Nonprofit Kft. 226 p. ISBN 978-615-5527-91-3., Available at: http://m.ludita.uni-nke.hu/repozitorium/handle/11410/10285

Recommended readings:

1) Hawley, Christopher (2018): Hazardous Materials Air Monitoring and Detection Devices. Jones & Bartlett Learning, Burlington, MA. 228 o. ISBN 978-1284143911.

2) National Fire Protection Association (NFPA) (2021): NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response. NFPA, Quincy, MA. ISBN 978-1455927517.
Responsible for course (name, position, scientific degree): **Dr. habil. József Dobor associate professor, PhD**
Other teachers (name, position, scientific degree): -

Title of the course: Basic knowledge in radiation protection and nuclear accident preparedness	**Code:** HKDID7418A	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **20/6**

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

Students will acquire theoretical and practical knowledge of the physical characteristics and biological effects of ionising radiation, as well as radiation protection principles, tools and procedures. Emphasis will be placed on emergencies in and around nuclear facilities and on the mechanisms for dealing with such events.

1) Radiation protection, radiological basics, dosimetry
2) Types of ionizing radiation and their characteristics (Alpha, beta, gamma and neutron radiation; - Radiation dose, units Gy, Sv)
3) Radiation effects on living organisms (Stochastic and deterministic effects; Basic concepts of radiobiology)
4) Use of radioactive substances in everyday life
5) The importance and dangers of nuclear power generation
6) Responsible organisations, authorities and supervisory bodies for radiation protection
7) Nuclear incidents in recent decades
8) Monitoring systems in our country and in Europe
9) Means, possibilities and implementation of nuclear accident management

Educational goal of subject - Competencies:

The course provides students with a knowledge of radiation protection and radiology. In particular, students will learn about measurement networks, the organisations responsible for radiation protection, the nuclear accidents that have occurred in recent decades, and the mitigation options and tools for damage control. Students will be able to understand the risks of radiation, recognise accident situations and interpret the necessary protection measures. The course will prepare them for their future role in nuclear safety and disaster management.

Required readings:

3) Pátzay György (2011): Atomenergetika és nukleáris technológia. Egyetemi tananyag. Typotex Kiadó, Budapest. ISBN 978-963-279-468-6.
4) Grupen, C. (2010). An introduction to radiation protection. Springer. https://doi.org/10.1007/978-3-642-02586-0, ISBN: 978-3-642-02585-3 (print), 978-3-642-02586-0 (eBook)
5) Kyne, D. (2017). Nuclear power plant emergencies in the USA: Managing risks, demographics and response. Springer. https://doi.org/10.1007/978-3-319-50343-1

Recommended readings:

3. Pátzay, G. (2014). Selective purification of radioactive liquid waste from normal operation and incidents at the Paks Nuclear Power Plant. Hadmérnök, 9(1), 117–123. ISSN 1788-1919
4. Dobor, J., Kiss, N., & Pátzay, G. (2022). Overview of the medical use of radioactive isotopes and their potential risks. Hadmérnök, 17(4), 101–112. ISSN 1788-1919

Responsible for course (name, position, scientific degree):
Prof. Em. György Pátzay, professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: **Case studies of Industrial Safety**	**Code:** HKDID7419A	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 20/6

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

To familiarise students with the characteristics, causes and consequences of Major Accident Hazard (MAH) industrial accidents in hazardous plants, and the measures required to deal with them. The course will place a strong emphasis on lessons learnt and analysis of preventive safety engineering systems in the study of a specific accident.

1. The concept of hazardous establishments (under the Seveso III Directive, industrial safety and the legal framework in Hungary and the EU, the obligation to notify and investigate major accidents)
2. analysis of case studies (study of typical examples, Seveso , Italy, 1976; Bhopal, India, 1984, methyl isocyanate spill, the worst accident in the history of the chemical industry; the red sludge disaster in Ajka, Hungary, 2010, domestic industrial safety and environmental consequences
4. conclusions and lessons learned (Common patterns and differences in the cases studied, Key role of prevention, surveillance and maintenance, Importance of risk assessment practices, HAZOP, bow-tie models)
5. Importance of post-incident intervention and practice (domestic and foreign practices)

Educational goal of subject - Competencies:

The course provides students with knowledge of industrial safety. In particular, students will learn about the analysis of the most relevant industrial safety incidents of the last decades. Finally, students will be introduced to the importance of immediate intervention and drills following incidents.

Required readings:

1. Lees, F. P. (2012): Lees' Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control. 4. kiadás. Butterworth-Heinemann, Oxford. ISBN 978-0-12-397189-0
2. NFPA (2019): NFPA 1600: Standard on Continuity, Emergency, and Crisis Management. National Fire Protection Association, Quincy, MA. ISBN 978-1-4559-2209-3.
3. Hopkins, A. (2000): Lessons from Longford: The Esso Gas Plant Explosion. CCH Australia, Sydney. ISBN 978-1-86468-422-3.

Recommended readings:

1. József Dobor (2018).Disaster management analysis of the use of hazardous organic substances and summary of the technological processes in organic chemistry. Military Engineer, Vol. XIII, KÖFOP special issue, pp. 43-61. ISSN 1788-1919., Available from: http://www.hadmernok.hu/180kofop_03_dobor2.pdf.

2. József Dobor (2018). Military Engineer, Vol. XIII, KÖFOP special issue, pp. 28-42., ISSN 1788-1919., Available: http://www.hadmernok.hu/180kofop_02_dobor1.pdf
Responsible for course (name, position, scientific degree): **Dr. habil. József Dobor associate professor, PhD**
Other teachers (name, position, scientific degree): -

Title of the course: **Disaster Management Monitoring Systems**	**Code: HKDID 7220A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **30/10**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4.

Pre-subject requirements *(if any)*: none

Course description:

1. The purpose of environmental and disaster monitoring systems.
2. Environmental load, emissions and pollution.
3. Processes threatening human life, health and material goods.
4. Types, application, structure and operation of environmental monitoring systems.
5. Types, application, structure and operation of disaster monitoring systems.
6. Types, operation and application rules of mobile and stable reconnaissance devices for hazardous materials.
7. Structure and application of the Monitoring and Public Alert (MoLaRi) system.

Competences:

The course acquaints students with the theoretical and practical background on the use of environmental and disaster monitoring systems. They acquire knowledge on the structure, operation and the installation of monitoring systems.

Required readings:

1. Lees, F. P., (1996). Loss Prevention in the Process Industries, Second Edition, Butterworth-Heinemann, London. ISBN 0-7506-1547-8.
2. TNO: Methods for Calculation of Physical Effects of the Escape of Dangerous Materials (Liquids and Gases), Nederlands Organisation for Applied Scientific Research, Voorburg, Directorate-General of Labour.
3. Julianna, Ősz Bíróné ; Imre, Bojti ; Zsolt, Cimer ; Imre, Damjanovich ; Imre, Hoffmann ; Béla, Szakál ; Gyula, Vass ; Lajos, Kátai-Urbán (szerk.) Guidance on the implementation of regional and local tasks for the prevention of major accidents involving dangerous substances. Budapest, Magyarország : Akaprint Kft. (2005) , 114 p. ISBN: 9632191129

Recommended readings:

1. Kátai-Urbán, Irina ; Cimer, Zsolt ; Szakál, Béla ; Vass, Gyula. Risk Management in population protection. SCIENCE FOR POPULATION PROTECTION 11 : 2 pp. 1-8. , 8 p. (2019)

Note: -

Responsible for course: COL. Dr. Gyula Vass associate professor, PhD

Other teachers: -

Title of the course: Protection against Major Accidents	**Code: HKDID7226A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **30/10**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4.

Pre-subject requirements *(if any)*: none

Course description:

1. International, EU and national legislation related to the protection against major accidents involving dangerous materials.
2. Fulfilment of operator obligations. Content and formal requirements of safety documents and their inspection.
3. Preparing, reviewing and applying internal and external safety plans.
4. Tasks and procedures related to public information and publicity. Report, information and inspection related to malfunctions and accidents involving dangerous materials.
5. Sanctions system and their imposition on dangerous establishments.
6. Authority regulations on technical, organisational and management measures to mitigate risks and consequences and their implementation by the operator.
7. The system and content of settlement planning. Designation of danger zone.
8. Methodology and procedure of authority tasks related to licensing, supervising and inspecting.

Competences:

Students are introduced to international and national legislation related to the protection against major accidents involving dangerous materials; industrial safety and disaster management procedures of the operator and the authority as well as the methods of risk analyses supporting them.

The course acquaints students with the procedures of inspection of safety documents in dangerous establishments, with special regard to the inspection procedures of risk analysis as well as external safety plans and public information.

Required readings:

2. Kátai-Urbán Lajos: Handbook for the Implementation of the Basic Tasks of the Hungarian Regulation on „Industrial Safety" Budapest: Nemzeti Közszolgálati Egyetem, 2014. 73 p. (ISBN 978-615-5491-70-2)
3. Kátai-Urbán L.: Establisment and Operation of the System for Industrial Safety within the Hungarian Disaster Management. ECOTERRA: JOURNAL OF ENVIRONMENTAL RESEARCH AND PROTECTION (ISSN: 1584-7071) 11: (2) pp. 27-45. (2014)
4. Lajos Kátai-Urbán (ed.): Guidance on the implementation of regional and local tasks for the prevention of major accidents involving dangerous substances.Budapest: Akaprint Kft., 2005. pp. 40-53. (ISBN: 963 219 112 9)

Recommended readings:

1. Kátai-Urbán Lajos, Vass Gyula: Safety of Hungarian Dangerous Establisments - Review of the Industrial Safety's Authority. HADMÉRNÖK IX.:(1) pp. 88-95. (2014)

Notes: -

Responsible for course:
COL. Dr. habil Lajos Kátai-Urbán associate professor, PhD

Other teachers: COL. Dr. habil. Gyula Vass PhD, associate professor

Title of the course: Carriage and Logistics of Dangerous Goods	**Code: HKDID7228A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **30/10**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4.

Pre-subject requirements *(if any)*: none

Course description:

1. Comprehensive assessment of international and national legislation. Criteria for the transport of hazardous materials by road, rail, air and inland waterway.
2. Dangerous goods logistics. Preparation for transport of goods. Storage and warehousing of dangerous goods. Rules for cargo securing.
3. The specifics of risk management and safety planning in establishments for dangerous goods transport.
4. Disaster management tasks and authorities of industrial supervision.

Competences:

This course provides a comprehensive understanding of theoretical and practical issues related to the safe transport and logistics of dangerous materials and goods. Students are introduced to the authorities, tasks and procedures set out in sectoral and international and national disaster management legislation related to the state supervision over transportation of dangerous goods.

Required readings:

1. UN Economic Commission for Europe: European Agreement concerning the International Carriage of Dangerous Goods by Road ADR applicable as from 1 January 2015. URL.: www.unece.org/trans/publications/dg_adr_2015.html (letöltés: 2015.05.15.)
2. UN Economic Commission for Europe: European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways URL.: www.unece.org/index.php?id=38257&L=0 (letöltés: 2015.05.15.)

Recommended readings:

1. Kátai-Urbán Lajos: Handbook for the Implementation of the Basic Tasks of the Hungarian Regulation on „Industrial Safety" Budapest: Nemzeti Közszolgálati Egyetem, 2014. 73 p. (ISBN 978-615-5491-70-2)
2. Kátai–Urbán Lajos; Kiss Enikő: Inspection of the Transportation of Dangerous Goods by Inland Waterways in Hungary. ACADEMIC AND APPLIED RESEARCH IN MILITARY SCIENCE (ISSN: 1588-8789) (eISSN: 1788-0017) 13: (2) pp. 261-266. (2014)

Notes: -

Responsible for course:

COL. Dr. habil. Gyula Vass PhD, associate professor

Other teachers:

COL. Dr. habil Lajos Kátai-Urbán associate professor, PhD

Title of the course: Planning, Organising and Executing Technical Rescue	**Code: HKDID7229A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) and learning hours (full time training/part time training): 30/10

Knowledge assessment (colloquium/academic grade/ other): colloquium

The course place in the curricula (in which semester): 2-4 semester

Pre-subject requirements *(if any)*: *none*

Course description

Organisational elements guaranteeing first intervention, technical rescue capabilities in Hungary and Worldwide. Their operation and typical intervention, technical rescue situations. The process, frame and elements, technical equipment of the technical rescues by the disaster management, fire units.

Educational goal of subject - Competences:

Developing wide knowledge about the organisation, staff and technology related to first interventions in Hungary and Worldwide. Ability to determine the requirements of certain situations, technical rescues.

Required readings:

1. Péter PÁNTYA: Special Vehicles and Equipment in Fire Operations Used in Different Regions, Academic and Applied Research in Military and Public Management Science, DOI: 10.32565/aarms.2023.1.1, (2023)
2. Péter PÁNTYA: Fire equipment capabilities testing results, Košická Bezpečnostná Revue 7:(2) pp. 105-113. (2017) ISSN 1338 – 6956
3. József Zsolt KERSÁK, Péter PÁNTYA: Opportunity for Technical Development in the Field of Practical Training in Case of Technical Rescue, VÉDELEM TUDOMÁNY 2498-6194, 2021
4. Péter PÁNTYA: Possibilities and dangers for the fire protection in the field of alternative energy sources, VÉDELEM TUDOMÁNY 2498-6194, (2021)
5. Péter PÁNTYA: Fire, Rescue, Disaster Management. Experiences from Different Countries, Academic and Applied Research in Military and Public Management Science 17 : 2 pp. 77-94. , 18 p. (2018)

Recommended readings:

6. Péter PÁNTYA: International Good Practices in the Activities of Fire and Disaster Management Organisations, Academic and Applied Research in Military and Public Management Science, DOI: 10.32565/aarms.2022.2.2, (2022)

Recommended websites: www.vedelem.hu, www.katasztrofavedelem.hu

Responsible for course (name, position, degree): Dr. Péter PÁNTYA, PhD., associate professor

Other teachers (name, position, degree): -

Title of the course: Planning, Organising and Executing Firefighting	**Code: HKDID7230A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **30/10**

Knowledge assessment (exam/academic grade): **Colloquium**

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

1. Regulation of the operations, technical rescue and disaster response activities of disaster management.
2. Dislocation of fire departments, the system of alarm and assistance.
3. The basics of staff service organisation. Organising fire fighting and technical rescue and the basics of on-duty service.
4. Management and procedure of fire fighting.
5. Management and procedure of technical rescue.

Competences:

This course provides a comprehensive understanding of regulations related to firefighting, technical rescue and disaster response. Students are introduced to the rules on organising firefighting and technical rescue as well as the conditions of safe interventions and technical rescue and their technical and organisational components.

Required readings:

1. Restás Á.: A Model for Firefighting Managers Making Decisions in Emergencies Proceedings of the 11th International Conference on Naturalistic Decision Making Marseille, France, 21-24.05.2013.
2. Bodnár László, Restás Ágoston, Xu Qiang: Conceptual Approach of Measuring the Professional and Economic Effectiveness of Drone Applications Supporting Forest fire Management, PROCEDIA ENGINEERING 211: (2018) pp. 8-17.
3. Restás, Á.: An Approach for Measuring the Economical Efficiency of Aerial Fire Fighting Wildfire2011: The 5th International Wildland Fire Conference: Sun City, South Africa, 09-13.05.2011.

Recommended readings:

1. Restás Á.: R-20 Method: An approach for measuring the isolation effect of foams used fighting forest fires AARMS 11:(2) pp. 233-247. (2012)
2. Assigned firefighting and fire investigating studies

Responsible for course (name, position, scientific degree):
Dr. habil. Restás Ágoston associate professor, Eng., PhD, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Population protection	**Code: HKDID7238A**	**Credits: 3**

Type of lessons (**lecture**/seminar/consultation) **and learning hours** (full time training/part time training): full time training: 30 hours, part time training: 10 hours

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: *no*

Course description:

- Description of the structure and operation of the professional disaster management organization system, legal bases defining the activities of disaster management.
- The purpose of the civil protection field, its main tasks in the period of prevention, protection and elimination of consequences.The importance of the risk assessment procedure and emergency planning for the protection of the population.
- Municipal tasks related to the field of civil protection. The connection of the local bodies of the professional disaster management organization system to the performance of municipal disaster management tasks.
- Significance and methods of public protection in the event of natural disasters by presenting case studies.
- Industrial safety aspects of civil protection. Civil protection tasks of local governments.The professional connections of the fire brigade in the field of public protection.

Educational goal of subject - Competencies:

During the lessons, the student should get acquainted with the operation of the professional disaster management organization system, paying special attention to the field of civil protection. Be able to identify the importance of risk identification, the links between emergency planning and public protection measures. Based on the knowledge acquired in the course, you should get to know the fire protection and industrial safety professional connections of the public protection, as well as the public protection tasks of the local governments.

Required readings:

1. Zsuzsanna Priváczki-Juhászné Hajdu, Árpád Muhoray: Improving resilience of settlements situated in plain areas in relation to inland excess water flood and drought risk POLGÁRI VÉDELMI SZEMLE 13 : Különszám pp. 238-266. , 29 p. (2020)
2. Sándor Nagy: The developmentof the risk assessment and risk management related to the protection of the population, author's presentation and official reviews of Doctoral (PhD) dissertation, University of Public Service, 2019.

Recommended readings:

1. Brigitta Sáfár: Deployment of standardized emergency response units in large scale emergencies MŰSZAKI KATONAI KÖZLÖNY 28 , 10 p. (2018)
2. Réka Magdolna Rácz: Outline of floods as well as flood prevention and flood protection activities in Hungary Academic And Applied Research In Military Science (AARMS) 10 : 1 pp. 123-129. , 7 p. (2011)

Responsible for course (name, position, scientific degree): Réka Kirovné Dr. Rácz, PhD.

Other teachers (name, position, scientific degree): -

Title of the course: Risk management of industrial technologies	**Code:** HKDID7239A	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **20/6**

Knowledge assessment (exam/academic grade): **exam**

Knowledge assessment (exam/academic grade): 2-4.

Pre-subject requirements *(if any)*: none

Course description:
General knowledge of hazardous substances: the concept of hazardous substances in different legal environments, physico-chemical parameters determining the properties of hazardous substances, safety data sheet.
Description of the most commonly used hazard analysis methods: fault tree analysis, hazard and operability study, Failure mode and effects analysis. The role of human error.
Consequence analysis: event tree analysis, reference event. Dangerous substance dispersion and consequence modelling, interpretation of results.
Concept of risk, steps of risk analysis, determination of individual risk and social risk. Input data and uncertainty for software modelling. Interpretation of results.
Risk management: definition and quantification of risk mitigation measures. Consideration of non-quantifiable risk mitigation measures.
Doctoral students will learn acquire the methods used to identify the hazards of industrial technologies and assess the consequences. Able to perform industrial safety assessments of industrial technologies, formulate risk reduction measures.

3-5 most important mandatory and elective references (author, edition, pages, ISBN)

Required readings:

1. Center for Chemical Process Safety (1989). Guidelines for Chemical Process Quantitative Risk Analysis. A.I.Ch.E., Center for Chemical Process Safety, NY. ISBN 0-8169-0402-2.
2. Lees, F. P., (1996). Loss Prevention in the Process Industries, Second Edition, Butterworth-Heinemann, London. ISBN 0-7506-1547-8.
3. TNO (1999, Purple Book). Committee for the Prevention of Disasters. CPR 18E . Guidelines for Quantitative Risk Assessment. The Director-General of Labour, The Netherlands

Recommended readings:

1. Szakál B, Cimer Zs: Major Disaster Recovery Plans. SCIENCE FOR POPULATION PROTECTION 6:(1) Paper Szakál, Cimer. 7 p. (2014)
2. Szakál B, Cimer Zs.: Analyses of professional dilemma surfaced when drafting the respective Hungarian regulations. SCIENCE FOR POPULATION PROTECTION 2:(2) pp. 1-13. (2010)
3. Szakál B, Cimer Zs. Analysing difficulties of risks arising from the storage of explosive materials. ANNUAL NEWS OF THE SZENT ISTVÁN UNIVERSITY YBL MIKLÓS FACULTACY OF BUILDING SCIENCES 8:(1) (2008)

Notes : -

Responsible for course: Dr. Cimer Zsolt PhD, associate professor

Other teachers: -

Title of the course: Fire prevention	**Code: HKDID7242A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **30/10**

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4.

Pre-subject requirements *(if any)*: none

Course description:

1. The content of international, EU and domestic regulations on fire protection, especially fire prevention.
2. Application of preventive fire protection of the construction, structure and content of fire protection technical design documentation.
3. Preparation, revision and application of the Fire Protection Technical Compliance Manual.
4. Application of preventive fire protection, fire protection regulations, structure and content of fire protection policy.
5. Preparation, review and application of fire protection regulations and fire alarm plan.
6. Methods for developing complex, long-term sustainable fire safety.
7. Innovative possibilities of applying engineering methods in preventive fire protection.
8. Official types of methodology and procedure for licensing, supervision and control activities of the competent authority.

Competences:

Students will acquire a comprehensive knowledge of preventive fire protection and fire prevention. The fire protection expertise of the science of prevention, the application of the National Fire Protection Regulations and the relevant Fire Protection Technical Guidelines in the fire protection engineering profession will be presented. The course provides a comprehensive overview of the basics of fire prevention: fire hazard classes, risk classes, evacuation, heat and smoke extraction, built-in fire alarm and fire extinguishing systems, fire protection, special facilities, etc. methods of installation and use. The students acquire the methodological and official procedures related to the preparation of the fire protection documentation (fire protection plan documentation, fire protection regulations, fire alarm plan) and the methodology of compiling the Fire Protection Technical Compliance Manual.

Required readings:

1. Tivadar Györkös: Fire Protection, Budapest, Complex Kiadó Kft., 2009., ISBN: 978 963 295 017 4
2. Josef Mayr, Lutz Battran: Handbuch Brandschutzatlas, Feuertrutz, 2018., ISBN: 978-3-86235-360-6

Recommended readings:

1. Morgan J. Hurley: SFPE Handbook of Fire Protection Engineering, 2016., ISBN: 978-1-4939-2564-3
2. Csaba Csepregi: Fire Alarm Systems, Budapest, Flórián Press Kiadó, 2001., pp.: 276., ISBN: 963-005-708-5
3. Gergő Érces: Fire prevention online guideline, Prezi, 2021. (https://prezi.com/p/bnvi-bouhdhm/?present=1)

Responsible for course: MAJ. Dr. Gergő Érces PhD., assistant professor

Other teachers: -

Title of the course: International disaster response	**Code: HKDID7245A**	**Credits: 3**

Type of lessons (**lecture**/seminar/consultation) **and learning hours** (full time training/part time training): full time training: 30 hours, part time training: 10 hours

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: *no*

Course description:

The concept of international disaster response, their main types, their characteristics. Presentation and comparison of the UN and EU disaster response systems with bilateral systems. The scope of the damage liquidation of the areas affected by the earthquake and by the flood, their main defining characteristics, the relationship of safe disaster management operations, their place in humanitarian operations. System of modules and RescEU capabilities that can be involved in the framework of the international UN INSARAG certified rescue teams and the EU Civil Protection Mechanism. Methods, planning and organization of urban search and rescue operations. The duties of the HUNOR Rescue Organization as a UN INSARAG heavy category urban search and rescue organization.

Educational goal of subject - Competencies:

The participants of the doctoral training will get to know the concept and characteristics of international disaster response, the range of consequences of damage caused by earthquakes and floods, and their main characteristics. Presentation of the complexity of the safe rescue activity to be carried out in the area affected by the disaster, as well as the relationship between the safe forms of rescue. To help students learn and understand new methods and procedures in the field.

The participants of the doctoral training should get to know and master it

- the general and special tasks of rescue after each type of disasters;
- the requirements for ensuring living conditions, the procedure for rescuing the population and those in distress;
- methods of planning rescue operations;
- knowledge about special rescue equipment.

Required readings:

1. *Jackovics Péter:* A műszaki mentés művelete összeomlott épületnél, a földrengéskutató és mentőcsapatok tevékenysége 1. rész, HADMÉRNÖK 15 : 4 pp. 61-88. , 28 p. (2020)
2. *Jackovics Péter*: A műszaki mentés művelete összeomlott épületnél, a földrengéskutató- és mentőcsapatok tevékenysége 2. rész, HADMÉRNÖK 16 : 1 pp. 95-112. , 18 p. (2021)
3. *Jackovics Péter: Az európai katasztrófa-beavatkozási képességek erősítése – a rescEU, BIZTONSÁGTUDOMÁNYI SZEMLE 2 : 3 pp. 1-12. , 12 p. (2020)*

4. *Jackovics Péter*: A polgári és katasztrófavédelem szerepe a nemzetközi katasztrófaelhárítás egészségügyi szerepében: 8. fejezet, Budapest, Semmelweis Kiadó (2019) , 23 p., ISBN: 9789633314951

Recommended readings:

1. *Richard Sliuzas - Jackovics Péter – Solveig Thorvaldsdóttir – Karolina Kalinowska - Pavlos Tyrologou - Christian Resch - Sergio Castellari – Stefan Greiving*: Risk management planning, Chapter 2.2, In: Casajus Valles, A.; Marin Ferrer, M.; Poljansek, K.; Clark, I. (szerk.) Science for Disaster Risk Management 2020, Luxembourg, Luxemburg : Publications Office of the European Union (2021) pp. 60-71. , 12 p.
2. *Jackovics Péter*: Deployability of international medical teams for disaster response, ECOTERRA: JOURNAL OF ENVIRONMENTAL RESEARCH AND PROTECTION 17 : 2 pp. 35-39. , 5 p. (2020)

Responsible for course (name, position, scientific degree): Col. Dr. Péter József Jackovics, PhD

Other teachers (name, position, scientific degree): -

Title of the course: The role of humanitarian organizations in emergency response operations	**Code: HKDID7250A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): full time training: 30 hours, part time training: 10 hours

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: *no*

Course description:

- Task system of humanitarian organizations during emergency situations and disasters.
- Role of national and international humanitarian organizations during emergency situations and disasters.
- The place of civil and humanitarian organizations in emergency response systems.
- Cooperation and coordination between governmental and humanitarian organizations in preparedness phase and during emergency response operations.
- Possibilities of applicability of standardized response systems used by humanitarian organizations.

Educational goal of subject - Competencies:
During the lessons, the student should identify the most important local and international actors of humanitarian assistance. Get to know the emergency task system and operation of humanitarian organizations. Be able to determine the place and role of humanitarian organizations in the response structure. Based on the knowledge acquired in the course, they should learn about the possibilities of cooperation between humanitarian organizations and professional organizations during the elimination of emergency situations.

Required readings:

1. Brigitta Sáfár: The role of humanitarian assistance in resilience development – an innovative research area; In: Molnár, András (szerk.) *First Conference on Effective Response* Budapest, Magyarország: Magyar Vöröskereszt 2020. 15-23.
2. Brigitta Sáfár: Deployment of standardized emergency response units in large scale emergencies *Műszaki Katonai Közlöny* 18; 3. szám. 2018. 164-173.

Recommended readings:

1. Brigitta Sáfár: Cooperation and coordination in international humanitarian assistance In: Molnár, András (szerk.) 2nd Conference on Effective Response; Budapest, Magyarország: Magyar Vöröskereszt, 2020. 17-28.
2. Réka Magdolna Rácz: Outline of floods as well as flood prevention and flood protection activities in Hungary Academic And Applied Research In Military Science (AARMS) 10 : 1 pp. 123-129. , 7 p. (2011)

Responsible for course (name, position, scientific degree): Dr. Sáfár Brigitta PhD

Title of the course: Modern methods for flood risk management	**Code: HKDID7251A**	**Credits: 3**

Type of lessons (**lecture**/seminar/consultation) **and learning hours** (full time training/part time training): full time training: 30 hours, part time training: 10 hours

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: *no*

Course description:
Within the framework of this subject

- students acquire knowledge about the different methods of flood control measures, water engineering technologies and strategies,
- they gather views of possible applications of the relevant technological solutions through Hungarian and international scope, from technical, strategic and legislative perspective.
- the subject makes a direct contribution to the understanding of modern, innovative solutions and opportunities that face new challenges.

Educational goal of subject - Competencies:

Students

- come to know the profession-specific definition background of flood risk management, understand the links between the different elements and able to implement them in practice,
- come to know the modern and contemporary flood control technologies and the possibilities of their application in local and regional level,
- acquires comprehensive knowledge about municipal and terrestrial flood control systems based on Hungarian and international practice,
- capable to implement tasks that treat the flood risk of a specific territory in specific or complex way by acquiring comprehensive knowledge about the purposes and operation of different flood control solutions,
- come to know the application of blue-green infrastructure elements in the field of water damage prevention,
- endeavour to ensure that her/his education is consistent with her/his professional goals and to comply with the conditions of scientific research.

Required readings:

1. Szlávik, Lajos Dr.: Flood protection and flood management. college book Eötvös József College, Baja, 2005. ISBN 963 7290 32
2. Szlávik, Lajos Dr; Nagy, László Dr.: Flood protection in practice. Ministry of Environment and Water Affairs, Budapest, 2003. ISBN 963 552 381 5, pp. 1-400
3. Szlávik, Lajos Dr: Educational guidance for flood protection. General Directorate of Water Management, 2016.

Recommended readings:

4. Mahler, András; Dr, TAKÁCS, Attila Dr: New Flood Protection Device Research Project, Budapest University of Technology and Economics Geotechnical Department, 2015, ISBN 978-80-972142-0-3
5. Hornyacsek, Júlia: The tasks and role of response in increasing the resilience of a community against disasters, Hadmérnök, XII. ÉVFOLYAM „KÖFOP" SZÁM, 2017. 25-48.
6. Gayer, József: Integrated approach to stormwater disposal in municipal areas, Corvinus University of Budapest, Budapest, 2004. pp. 1-119.
7. Antal, Örs: The theoretical and technical issues of effective protection in the period of prevention against the harmful effects of disasters caused by floods and earthquakes, doctoral thesis, National Univesity of Public Service, Budapest, 2018.
8. Antal, Örs: Flood risk in Hungary in light of influencing tendencies, Bolyai Szemle XXIV/1. pp. 1-15.
9. Antal, Örs: Green Infrastructure Solutions for Flood Prevention – Innovative Investment Opportunities, Bolyai Szemle, 2018/1:124

Responsible for course (name, position, scientific degree): Dr. Antal Örs PhD

Other teachers (name, position, scientific degree): Dr. habil. Hornyacsek Júlia

Title of the course: Basic knowledge in radiation protection and nuclear accident preparedness	**Code:** HKDID7418A	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **20/6**

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

1) Radiation protection, radiological funds, dosimetry
2) The use of radioactive materials in everyday life
3) The importance of nuclear power generation and risks
4) The radiation protection authorities, inspection services
5) Description of nuclear accidents occurring in recent decades
6) Monitoring systems in our country and in Europe
7) Emergency preparedness tools, opportunities, achievement

Educational goal of subject - Competencies:

The course students acquire knowledge of radiation protection and the radiology. Within this measurement networks, organizations responsible for radiation protection, nuclear accidents have occurred in recent decades, and the mitigation and remediation possibilities toolkit also get to know the students.

Required readings:

1. J. Shapiro, Radiation Protection, HARVARD UNIVERSITY PRESS Cambridge, Massachusetts, and London, England, www.ilea.ufrgs.br/radioisotopos/livroradio.pdf
2. DOE FUNDAMENTALS HANDBOOK, NUCLEAR PHYSICS AND REACTOR THEORY, Volume 1 and 2, JANUARY 1993 http://energy.gov/sites/prod/files/2013/06/f2/h1019v1.pdf http://www.steamtablesonline.com/pdf/Nuclear-Volume2.pdf

Recommended readings:

1. Pátzay, Gy ; Weiser, L ; Feil, F ; Patek, G: Analysis and Selective Treatment of Radioactive Waste Waters and Sludges in Waste Water: Chapter 9. In: Fernando, Sabastian Garcia - Fernando, Sabastian Garcia (szerk.) Waste Water- Evaluation and Management. Rijeka, Horvátország : InTech Education and Publishing, (2011) pp. 203-216. , 14 p.
2. Dávid, Havasi ; Ádám, Hajnal ; György, Pátzay ; László, T Mika. Vapor–Liquid Equilibrium of γ-Valerolactone and Formic Acid at JOURNAL OF CHEMICAL AND ENGINEERING DATA 62 : 3 pp. 1058-1062. , 5 p. (2017)

Responsible for course (name, position, scientific degree):

Prof. Em. György Pátzay, professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: **Case studies of Industrial Safety**	**Code:** HKDID7419A	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 20/6

Knowledge assessment (exam/academic grade): term mark

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

1. The definition, organisation (fields of activity, functions) of industrial safety
2. Professional evaluation of major national incidents
3. Professional evaluation of major European incidents
4. Response to incidents and the importance of (national and international) drills

Educational goal of subject - Competencies:

The course acquaints students with knowledge of industrial safety. More specifically, incidents over the last decades relevant to industrial safety are covered. Finally, students are introduced to the possibilities of interventions and the importance of drills.

Required readings:

1. Edited by Andre Richardt, Birgit H¨ulseweh, Bernd Niemeyer, Frank Sabath: CBRN Protection, Managing the Threat of Chemical, Biological, Radioactive and Nuclear Weapons, ePDF ISBN: 978-3-527-65019-4, Wiley-VCH Verlag & Co. KGaA, Boschstr., 2013
2. Ratan Raj Tatiya: Elements of Industrial Hazards Health, Safety, Environment and Loss Prevention, ISBN: 978-0-203-83612-5 (eBook - PDF), CRC Press Taylor & Francis Group, 2010
3. Philip E. Hagan, John F. Montgomery, James T. O'Reilly: Accident prevention manual for business & industry engineering & technology, ISBN 0-87912-213-7, National Safety Council, 12th edition, Illinois, 2001
4. Nicolas A. Valcik and Paul E. Tracy: Case studies in disaster response and emergency management, ISBN 978-1-4398-8317-4 (eBook - PDF), CRC PressTaylor & Francis Group, 2013

Recommended readings:

3. Anthony D. Manley: Security Manager's Guide to Disasters Managing Through Emergencies, Violence, and Other Workplace Threats, CRC PressTaylor & Francis Group, ISBN 978-1-4398-0906-8 (Book), 2009
4. Dobor József: Major Chemical Accidents in the 21st Century Europe and its Lessons Learned in Higher Education, Academic and applied research in military and public management science, ISSN: 2498-5392, 16: (3) pp. 93-108., 2017, Hadtudományi Bizottság A, https://www.uni-nke.hu/document/uni-nke-hu/AARMS_2017_03_06Dobor.pdf

Responsible for course (name, position, scientific degree):
Dr. habil. József Dobor associate professor, PhD

Other teachers (name, position, scientific degree): -

Title of the course: Risk and Consequence Analyses in the field of Industrial safety	**Code: HKDID7420A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **20/6**

Knowledge assessment (exam/academic grade): **term mark**

Knowledge assessment (exam/academic grade): 2-4.

Pre-subject requirements *(if any)*: none

Course description:

The basics of chemical safety. Identifying below-tier establishments dealing with dangerous materials.

1. Analyses of risk sources. Internationally accepted methods for analysis, their methodology and application.
2. Identifying major accidents involving dangerous materials, analysing their consequences, determining and ranking the frequency of their occurrence.
3. Identifying individual and societal risks.
4. Technical, organisational and managerial measures to mitigate the risks and consequences.
5. Individual risk for injury and designating danger zone.

Competences:

Students become acquainted with the identification of dangerous activities, review of safety documentation and management systems, the technical requirements as well as the application of risk- and consequence analysing software with sample-scenarios.

Required readings:

1. Center for Chemical Process Safety (1989). Guidelines for Chemical Process Quantitative Risk Analysis. A.I.Ch.E., Center for Chemical Process Safety, NY. ISBN 0-8169-0402-2.
2. Lees, F. P., (1996). Loss Prevention in the Process Industries, Second Edition, Butterworth-Heinemann, London. ISBN 0-7506-1547-8.
3. TNO (1999, Purple Book). Committee for the Prevention of Disasters. CPR 18E . Guidelines for Quantitative Risk Assessment. The Director-General of Labour, The Netherlands

Recommended readings:

1. Szakál B, Cimer Zs: Major Disaster Recovery Plans. SCIENCE FOR POPULATION PROTECTION 6:(1) Paper Szakál, Cimer. 7 p. (2014)
2. Szakál B, Címer Zs.: Analyses of professional dilemma surfaced when drafting the respective Hungarian regulations. SCIENCE FOR POPULATION PROTECTION 2:(2) pp. 1-13. (2010)
3. Szakál B, Címer Zs. Analysing difficulties of risks arising from the storage of explosive materials.ANNUAL NEWS OF THE SZENT ISTVÁN UNIVERSITY YBL MIKLÓS FACULTACY OF BUILDING SCIENCES 8:(1) (2008)

Responsible for course: Dr. Cimer Zsolt PhD, associate professor

Other teachers:

Prof. Dr. habil. Szakál Béla, PhD, college professor

Title of the course: **Fire prevention activities**	**Code: HKDID 7423A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **20/6**

Knowledge assessment (exam/academic grade): **term mark**

The course place in the curricula (in which semester): 2-4 semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:

Legislation on fire prevention, legislative environment. Basic related concepts. Basic guidelines in fire prevention planning, risk-based planning. Fire safety requirements of building materials and building structures, performance indicators. Requirements of evacuation. Creating conditions for interventions. General rules for fire alarms and sprinklers. Installation and regular maintenance. Flammable liquids and melts. General fire protection rules of their use.

Educational goal of subject - Competencies:

This course provides students with a basic understanding of fire prevention. They receive a comprehensive and detailed overview of basic guidelines and concepts in fire protection and fire safety requirements of buildings. Students are introduced to the conditions that ensure fire interventions through practical examples. The course acquaints students with practical knowledge on fire protection equipment and rules on their installation and use.

Required readings:

1. National Fire Prevention Rules (Act)
2. Legislation in force of fire prevention (BM OKF)
3. Restás Á.: R-20 Method: An approach for measuring the isolation effect of foams used fighting forest fires AARMS 11:(2) pp. 233-247. (2012)

Recommended readings:

1. Fire protection technical directives (BM OKF)
2. Restás, Á.: An Approach for Measuring the Economical Efficiency of Aerial Fire Fighting Wildfire2011: The 5th International Wildland Fire Conference: Sun City, South Africa, 09-13.05.2011.

Responsible for course (name, position, scientific degree):
Dr. habil. Restás Ágoston associate professor, PhD, PhD

Other teachers (name, position, scientific degree): -

Title of the course: The Safety of Firefighter Interventions	**Code: HKDID7424/a**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) and learning hours: 20/6

Knowledge assessment (colloquium/academic grade/ other): academic grade

The course place in the curricula (in which semester): 2-4. semester

Pre-subject requirements *(if any)*: *none*

Description - **Knowledge:**

During the firefighter interventions, examining safety of intervention, including the issues of safety of victims, the intervention teams and the success of the intervention. Organizational elements guaranteeing first intervention capabilities, the circumstances of interventions, the options to improve the safety.

Educational goal of subject - **Competences:**

The knowledge of the primary interventions, situations at the scene, the first responder forces and technical opportunities. Competences to find danger sources at the different scenes, to discover the best ways of protection against them.

Required readings:

1) Péter PÁNTYA: What can Help for the Firefighters?, Zvolen: Technicka Univerzita v Kosiciach, 2015. 10 p., Advances In Fire & Safety Engineering, (ISBN:9788022828239)
2) Lilla HORVÁTH, Péter PÁNTYA: Presentation of the Hazardous Environment in the Light of Firefighting Activity, Műszaki Katonai Közlöny, DOI: 10.32562/mkk.2023.1.6, (2023)
3) Péter PÁNTYA: Fire equipment capabilities testing results, Košická Bezpečnostná Revue 7:(2) pp. 105-113. (2017) ISSN 1338 – 6956
4) Lilla HORVÁTH, Péter PÁNTYA: Analysis of the Material Characteristics of Firefighter Personal Protective Clothing, Hadmérnök, DOI: 10.32567/hm.2023.2.4, (2023)

Recommended readings:

5) Péter PÁNTYA: Special Vehicles and Equipment in Fire Operations Used in Different Regions, Academic and Applied Research in Military and Public Management Science, DOI: 10.32565/aarms.2023.1.1, (2023)
6) Péter PÁNTYA: International Good Practices in the Activities of Fire and Disaster Management Organisations, Academic and Applied Research in Military and Public Management Science, DOI: 10.32565/aarms.2022.2.2, (2022)

Recommended websites: www.vedelem.hu, www.katasztrofavedelem.hu

Responsible for course (name, position, degree): Dr. Péter Pántya, PhD., associate professor PhD

Other teachers (name, position, degree):

Title of the course: Relationship between disasters and the geographic space	**Code: HKDID7426A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) and learning hours: N: 20 ó./L: 6 ó.

Knowledge assessment (colloquium/academic grade/ other): **academic grade** - mid-semester evaluation

The course place in the curricula (in which semester): **2-4.** semester

Pre-subject requirements *(if any)*: *none*

Description - **Knowledge:**
The relationship between security and geography. Geographical evaluation of the continents from security and disasters points of view. Consequences of natural disasters and its security relations on the example of the continents (Europe, Asia, Africa, Central and South America, Australia). The effects, consequences and implications of man-made disasters, and their relationship with security (nuclear power stations, chemical, biological and radiological accidents etc.) Geographical evaluation of Hungary (geographical location, physical, social, and economic geography) from the point of view of security and disasters. Individual preparation of the Case Study of a given country, a region or sub-region evaluation from the disaster geographical point of view.

Educational goal of subject - **Competencies:**
The doctoral students learn about and are aware of security and geo-spatial relationship, the use of geographic information systems in the emergence and prevention of disasters, each continents' and Hungary's physical, economic and social geographical specificities, the geographical knowledge that fundamentally determine security, their impact on security and geography of disasters.

Required readings:
Siposné Kecskeméthy Klára: Katonaföldrajzi szócikkek, [Military Geography] In: Forgács Balázs et alii. (Szerk.) Hadtudományi Lexikon, Új kötet, Budapest, Ludovika Egyetemi Kiadó (2019). ISBN 978-963-531-101-9 (In Hungarian)

The Federal Response to Katrina Hurricane Lessons Learned, February 2006, The White House, Washington, p. 228.
https://georgewbush-whitehouse.archives.gov/reports/katrina-lessons-learned/

Tamás, Almási-Klára, Siposné Kecskeméthy: The health risks of global warming and climate change – The Yamal peninsula case In: Michal, HRNČIAR (szerk.) Zborník príspevkov z 9. medzinárodnej vedeckej konferencie, Liptovskỳ Mikuláš, Akadémia ozbrojených síl generála Milana Rastislava Štefánika, (2018) pp. 16-28.
https://www.aos.sk/www/data/uploads/files/Katedry/KBO/NMB/zbornik-nmb-2018.pdf#page=17

Recommended readings:
Siposné Kecskeméthy Klára-Teknős László: North Atlantic Treaty Organisation's climate change risk management responsibilities, Belügyi Szemle, 2023. 71. évfolyam, 1. Különszám, pp. 58-83.
Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station, INPO-11-005, November 2011. Institute of Nuclear Power Operations. Atlanta

https://hps.org/documents/INPO_Fukushima_Special_Report.pdf Philip R. Stone, Rudi Hartmann, Tony Seaton, Richard Sharpley, Leanne White (eds.): The Palgrave Handbook of Dark Tourims, Palgrave Macmillan, 2018, p. 781.
Responsible for course (name, position, degree): Prof. Klára Sipos Kecskeméthy CSc
Other teachers (name, position, scientific degree): -

Title of the course: Safety Engineering	**Code: HKDID6216A**	**Credits: 3**

Type of lessons: lecture/seminar/***consultation*** **and learning hours**: Lecture *30/10 hours* / Consultation: *4*

Knowledge assessment (exam/academic grade): ***exam***

The course place in the curricula (in which semester):

Pre-subject requirements *(if any)*: *none*

Course description:
Theoretical background of reliabilityand technical sefety. The components' and systems' reliability. Reliability of Systems with Complex Interconnections. Reserving methods. The human factors. Fault Tree Analysis (FTA); Event Tree Analysis (ETA); Ishikawa analysis; Failure Mode and Effects Analysis (FMEA); Pareto analysis; Root Cause Analysis (RCA); Monte Carlo Simulation (MCS).

Educational goal of subject - Competencies:
To give a general overview about the role of the sefety enginering in the military operations, as well as make a basis of methods of technical reliability focus on the military equipment operations and maintenance.

Required readings:

1. Bauer, E., Zhang, X., Kimber D.A., "Practical System Reliability", John Wiley & Sons, 2009.
2. Myers, "Complex System Reliability" Springer-Verlag, 2010.
3. Ushakov, "Handbook of Reliability Engineering", John Wiley & Sons, 1994.

Recommended readings:

1. Pokorádi, László, MODELS IN SAFETY MANAGEMENT, MACHINE DESIGN 11 : 3 pp. 85-94. , 10 p. (2019).

Responsible for course (name, position, scientific degree): Prof. .Dr. Pokorádi László, full professor, CSc (technical sciences)

Other teachers (name, position, scientific degree): –

Title of the course: **Modelling of Technical Systems**	**Code: HKDID6217A**	**Credits: 3**

Type of lessons: lecture/seminar/***consultation*** **and learning hours**: Lecture *30/10 hours* / Consultation: *4*

Knowledge assessment (exam/academic grade): ***exam***

The course place in the curricula (in which semester):

Pre-subject requirements *(if any)*: *none*

Course description:
Theoretical background of system emgineering, modelling of technical systems. Clasiffication of models. Methodology of mathematical modeling. One- and Multi-parametrical Sensitivity Analysis. The dimensional Analysis. The stateestimation methods. Modell uncertainties.

Educational goal of subject - Competencies:
To give a general overview about the role of mathematical modelling of technical systems, as well as make a basis of the mathemaztical model-based investigation of military equipment.

Required readings:

1. Heinz, Mathematical Modeling, Springer Heidelberg Dordrecht London New York, 2011.
2. Pokorádi, László, Szabolcsi, Róbert, Mathematical Models Applied to Investigate Aircraft Systems, nomográfia, Monographical Booklets in Applied and Computer Mathematics, MB-12, PAMM, Műegyetemi Kiadó, Budapest, 1999., p. 146.
3. Baoding L., Uncertainty Theory, Springer, Berlin, 2010. p. 350

Recommended readings:

1. Pokorádi László Logical Tree of Mathematical Modeling, THEORY AND APPLICATIONS OF MATHEMATICS & COMPUTER SCIENCE 5 : 1 pp. 20-28. , 9 p. (2015).
2. Pokorádi László, Graph model-based analysis of technical systems, IOP CONFERENCE SERIES: MATERIALS SCIENCE AND ENGINEERING 393 : 1 Paper: 012007 , 8 p. (2018).

Responsible for course (name, position, scientific degree): Prof.Dr. Pokorádi László, full professor, CSc (technical sciences)

Other teachers (name, position, scientific degree): –

Title of the course: **Modelling of Maintenance processes**	**Code: HKDID6218A**	**Credits: 3**

Type of lessons: lecture/seminar/***consultation*** **and learning hours**: Lecture *30/10 hours* / Consultation: *4*

Knowledge assessment (exam/academic grade): ***exam***

The course place in the curricula (in which semester):

Pre-subject requirements *(if any)*: *none*

Course description:
Theoretical background of maintemance management. Strategies of maintenance. Clafisications of failures. Aging theory. Application of theory of Markov-processes ti investigate maintenance processes. The modern maintenance philosophies, Total Productive Management, Realibility Centered Management.

Educational goal of subject - Competencies:
To give a general overview about the role of maintenance and maintenance management in the military operations, as well as make a basis of modern, mathematical modell-based maintenance management of military equipment.

Required readings:

1. Riccardo Manzini, Alberto Regattieri, Hoang Pham, Emilio Ferrari, Maintenance for Industrial Systems, Springer-Verlag, London, 2010.
2. Jardin A.K.S., Tsang A.H.C. Maintenance, Replacement, and Reliability: Theory and Applications. New York: Taylor & Francis, 2006.
3. Karlin, S., Taylor H.M. A First Course in Stochastic Processes. London: Academic Press, 1985.

Recommended readings:

1. Pokorádi László, Availability assessment with Monte-Carlo simulation of maintenance process model POLYTECHNICAL UNIVERSITY OF BUCHAREST. SCIENTIFIC BULLETIN. SERIES D: MECHANICAL ENGINEERING 78 : 3 pp. 43-54. , 12 p. (2016)
2. Pokorádi László, MODELS IN SAFETY MANAGEMENT, MACHINE DESIGN 11 : 3 pp. 85-94. , 10 p. (2019)

Responsible for course (name, position, scientific degree): Prof. Dr. Pokorádi László, full professor, CSc (technical sciences)

Other teachers (name, position, scientific degree): –

Title of the course: Automatic Flight Control Systems of the UAVs	**Code: HKDID8210A**	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 30 /10 Hrs

Knowledge assessment (exam/academic grade): Exam (E)

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: -

Course description: Mathematical models of the spatial motion of the UAV. 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, LQG, LQG/LTR methods. Controller synthesis using robust H2 and Hinf methods.

Educational goal of subject - Competencies: Ability to understand and solve closed loop synthesis and scheduling problems using MATLAB

Required readings:

1. McLean, D. Automatic Flight Control Systems. Prentice-Hall, 1990.
2. Stevens, B.L., Lewis, F.L. Aircraft Control and Simulation. New York, USA, Wiley-Interscience, 1992.
3. Nelson, R.C. Flight Stability and Automatic Control. McGraw-Hill International Editions, ISBN 0-07-046273-9, 1998.
4. Stevens, B.L., Lewis, F.L., Johnson, E.N: *Aircraft Control and Simulation: Dynamics, Control Design and Autonomous Systems*. Wiley-Blackwell, 3rd Edition, 2015.

Recommended readings:

1. Valavanis, K.P. (ed.) Advances in Unmanned Aerial Systems. Springer, ISBN 978-1-4020-6113-4, 2007.
2. Austin, R. Unmanned Aircraft Systems – UAVs Design, Development and Deployment. John Wiley & Sons, Ltd., ISBN 978-0-470-05819-0, 2010.
3. Beard, R.W., McLain, T.W.: Small Unmanned Aircraft. Thoery and Practice. Princeton University Press, ISBN 978-0-0691-14921-9, 2012.
4. Yedavalli, R.K.: *Flight Dynamics and Control of Aero and Space Vehicles*. John Wilwy & Sons, Ltd., 2020.

Responsible for course (name, position, scientific degree): Prof. Dr. Szabolcsi Róbert

Other teachers (name, position, scientific degree): —

Title of the course: Human Factors in flight safety, causes of sudden incapacitation and human error from the aspects of Human-System Integration, possible countermeasures and prevention by tools of ergonomy and technical-technological solutions	**Code: HKDID6415A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): **research seminar: full time training: 20 hrs/ part time training: 6 hrs**

Knowledge assessment (exam/academic grade): **G (Practice note)**

The course place in the curricula (in which semester): depends on the individual educational program **3.-4. semester**

Pre-subject requirements *(if any)*: --

Course description:

Educational goal of subject Regarding the mutual dynamic relationship between man-machine-environment settings in aviation the weakest chain is the human factor, analysis of flight safety factors influencing the actual performance and working capacity of the pilot is a must. To interrupt the chainlink ending in air accident a systemic approach is necessary, considering the selection of the best applicants, their regular medical assessment for fitness for flight, mental and physical performance enhancement, continuous development of Human-System Integration and cockpit ergonomic elements. New medical evaluation of stressz tolerance with new protocols in ground based simulation is very important.

Competencies: Analysis of Human Factor's role in aviation especially considering the aeromedical stress assessment.. New effective „real-time" biomedical monitoring for cardiovascular adaptive responses. Assessment of predicitive validity for selection processes through analysis of stress tolerance. Comprehension of psychic and cognitive regenerative capibility after air accidents/medical treatment (medication). Stress level limitation by preventive measures in altitude physiology and ergonomy related technologies. Protocol development and test execution in ground-based simulated aeromedical stressor situation, preparing for real flight data recordings.

Required readings:

1. HUM.ET1.ST13.3000-REP-02 Human Factors in the Investigation of Accidents and Incidents. https://www.eurocontrol.int/sites/default/files/content/documents/nm/safety/safety-human-factors-module-human-factors-in-the-investigation-of-accidents-and-incidents-1998.pdf
2. Human Performance and Limitations in Aviation 3rd edition Editor: M. Bagshaw, R D Campbell, ISBN:0632059656
3. Handbook of Aviation Human Factors. 2nd Ed. Editors: John A. Wise, V. David Hopkin, Daniel J. Garland. CRC Press Taylor and Francis Group. 6000 Broken Sound Parkway NW, Suite 300Boca Raton, FL 33487-2742 ISBN 978-0-8058-5906-5

Recommended readings:

1. Fundamentals of Aerospace Medicine Ed.: Jeffrey R. Davis, MD, MS 4th Edition, 2008 By Lippincott Williams & Wilkins, A Wolters Kluwer Business, 2002, 1996, 1986 by Lippincott Williams & Wilkins, ISBN 978-0-7817-7466-6
2. HUMAN ERROR – James Reason, Cambridge University Press 1990. New York, ISBN 978 0 521 31419 0 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1070929/)
3. Human Performance and Limitations in Aviation 3rd edition Editor: M. Bagshaw, R D Campbell, ISBN:0632059656

Responsible for course (name, position, scientific degree): ***Col. Dr. habil.Sándor SZABÓ, PhD, Chief Flight Surgeon of Hungarian Defence Forces***

Title of the course: Programming in MATLAB	**Code: HKDID8409A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): 20/6 Hrs computer lab

Knowledge assessment (exam/academic grade): **-**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: -

Course description: MATLAB basics. Matrix calculus. Analysis of basic terms in time and in frequency domain. Open loop and closed loop control systems analysis in time and in frequency domain. Controller synthesis using classical approach (pole placement). Controller synthesis using optimal LQR, LQG, LQG/LTR methods. Controller synthesis using robust H2 and Hinf methods.

Educational goal of subject - Competencies: Ability to understand and solve closed loop synthesis and scheduling problems using MATLAB

Required readings:

1. Burns, R. S. *Advanced Control Engineering*: Butterworth-Heinemann, Oxford-Auckland-Boston-Johannesburg-Melbourne-New Delhi, 2001.
2. Nise, N. S. *Control Systems Engineering,* John Wiley & Sons, Inc., 2004.
3. Dorf, C.R., Bishop, R.H.: Modern Control Systems. Pearson Education Limited, Edinburg Gate, 2014.

Recommended readings:

1. Szabolcsi, R. Korszerű szabályozási rendszerek számítógépes tervezése. ZMNE, ISBN 978-615-5057-26-7, p415, 2011.
2. Szabolcsi, R.: *Szabályozáselmélet*. Budapest, Óbudai Egyetem, ISBN 978-963-449-188-0, 2019, p470.
3. Szabolcsi, R.: *Irányítástechnikai rendszerek tervezése és vizsgálata MATLAB® környezetben*. Budapest, Óbudai Egyetem, ISBN 978-963-449-187-3, p398, 2020.

Responsible for course (name, position, scientific degree): Prof. Dr. habil. Róbert Szabolcsi (PhD)

Other teachers (name, position, scientific degree): -

Title of the course: Water resources management: discourse, decision making, implementation, operation	**Code: HKDID9201A**	**Credits: 3**

Type of lessons (**lecture**/seminar/consultation) **and learning hours** (full time training/part time training): 30/10 hours with homework essay

Knowledge assessment (exam/academic grade): **examination (oral)**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program): 2. or 3. semester

Pre-subject requirements *(if any)*: *none*

Course description: Introduction of the challenges and international discourse of water resources management, the systems analytical support of decision making, the realization of water resources davelopment and the operation of water resources systems. Several complex case study examples will show the political embedding of water resources management at various scales. Inter- and transdisciplinary aspects including the consideration of stakeholder interests and analysis of the inherent problems.

Educational goal of subject - **Competencies:** The students will acquire competencies to participate in the water resources management discourse, obtain a critical view and will be able to engage in inter- and transdisciplinary activities related to the use, distribution (sharing) and safeguarding water resources and aquatic ecosystems.

Required readings:

Selected chapters of Bogardi, J.J., Tingsanchali, T., Bhaduri, A., Nandalal, K.D.W., van Nooijen, R.R.P., Gupta, J., Kolechkina, A.G., Salamé, L., Kumar, N. (Eds.) 2021: Handbook of Water Resources Management: Discourses, Concepts and Examples. Springer, Cham, Switzerland, 810 p

Handouts.

Recommended readings: Borchardt D., Bogardi J., Ibisch R. editors 2016: Integrated Water Resources Management: Concept, Research and Implementation. Springer International Publishing, Cham, Switzerland 781 p.

Bogardi J., Leentvaar J., Nachtnebel H.-P. editors 2012: River Basins and Change, Global Water System Project and UNESCO IHE, e-book, www.gwsp.org, 206 p.

Pahl-Wostl C., Bhaduri A., Gupta J. Editors 2016: Handbook on Water Security, Edward Elgar 384 p. ISBN 978 1 7825480 3

Responsible for course (name, position, scientific degree): János J. Bogárdi, research professor, Dr.-Ing. Dr. h.c. mult

Other teachers (name, position, scientific degree):

Title of the course: Computational Hydraulics – Open Channels – 1D models	**Code:** HKDID9202A	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): lectures 30/10 hours

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
General introduction to numerical methods (the finite element method, the characteristics method, the finite difference method, stability, convergence, accuracy). *1D pollutant transport in open channel flows* (the mass conservation equation, advection, the methods of finite differences, characteristics method, diffusion, hybrid methods). *1D unsteady flow in open channel flows* (the integral form of the equations, the differential form of the equations, the method of finite differences, Preissmann's scheme, boundary conditions, "internal" boundary conditions).

Educational goal of subject - Competencies:
Students completing the course will be able to interpret and develop 1D numerical models to describe relevant flow processes in open channels. They will become familiar with numerical solution techniques used in 1D hydraulic modeling, laying the foundation for their subsequent research in this field.

Required readings:

1. Wu, Weiming. Computational River Dynamics. Taylor & Francis Group, London, UK, 2008. ISBN: 978-0-203-93848-5 (e-book)
2. Hirsch, Charles. Numerical Computation of Internal and External Flows - Volume 1 - Fundamentals of Computational Fluid Dynamics, Elsevier, Oxford, 2007. ISBN: 978-0-7506-6594-0
3. Biringen, Sedat; Chow, Chuen-Yen. An introduction to computational fluid mechanics by example. John Wiley & Sons, Inc., Hoboken, New Jersey, USA, 2011. ISBN 978-0-470-10226-8

Recommended readings:

1. Holly, F.M., Cunge, J.A. Practical Aspects of Computational River Hydraulics, Pitman Publishing Co., 1980. ISBN 978-0273084426

Responsible for course (name, position, scientific degree): Dr. Horváth Mirjana, Associate Professor, PhD

Other teachers (name, position, scientific degree):

Title of the course: Computational Hydraulics – Open Channels – 2D models	**Code:** HKDID9203A	**Credits: 3**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): lectures 30/10 hours

Knowledge assessment (exam/academic grade): **exam**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: none

Course description:
Numerical solutions for 2D problems (method of characteristics, finite difference method, linearization of a nonlinear system of equations). *Transport of pollutants in 2D open channel flows* (the mass conservation equation, the fractional step method – advection and diffusion steps, methods for solving the advection step, methods for solving the diffusion step). *Unsteady flow in open channel flows* (general equations of mass and momentum conservation, fractional step method – advection, diffusion, and propagation steps, methods for solving the advection step, methods for solving the diffusion step, methods for solving the propagation step).

Educational goal of subject - Competencies:
Students completing the course will be able to compile numerical models to describe flow and pollutant transport processes in open channel flows. They will also become familiar with numerical solution techniques useful in 2D hydraulic modeling and pollutant transport in flows.

Required readings:

4. Wu, Weiming. Computational River Dynamics. Taylor & Francis Group, London, UK, 2008. ISBN: 978-0-203-93848-5 (e-book)
5. Garcia, Marcelo H (Ed.). Sedimentation Engineering: Theories, Measurements, Modeling and Practice: Processes, Management, Modeling, and Practice. American Society of Civil Engineers, 2008. ISBN: 978-0784408148
6. Biringen, Sedat; Chow, Chuen-Yen. An introduction to computational fluid mechanics by example. John Wiley & Sons, Inc., Hoboken, New Jersey, USA, 2011. ISBN 978-0-470-10226-8

Recommended readings:

2. Hirsch, Charles. Numerical Computation of Internal and External Flows - Volume 1 - Fundamentals of Computational Fluid Dynamics, Elsevier, Oxford, 2007. ISBN: 978-0-7506-6594-0

Responsible for course (name, position, scientific degree): Dr. Horváth Zoltán, Associate Professor, PhD

Other teachers (name, position, scientific degree):

Title of the course: Reconstruction of environmental changes	**Code: HKDID9401A**	**Credits: 2**

Type of lessons (lecture/seminar/consultation) **and learning hours** (full time training/part time training): lecture 20/6 h

Knowledge assessment (exam/academic grade): **academic grade**

The course place in the curricula (in which semester): 2-4. semester (depends on the individual educational program)

Pre-subject requirements *(if any)*: -

Course description:
The purpose, scope and review of national and international research on environmental reconstruction. Specificities of the study of the main objects of investigation (lentic waters) of the sciences dealing with sediment reconstruction (palaeoecology, palaeolimnology). Geological developments, sedimentological, geochemical and palaeoecological archives of sediments. Sampling techniques. Stratigraphic methods. Methods of determination. Biotic remains in sediments (major groups): pollen, diatoms, cladocerans, insects (Chironomidae, Chaoboridae). Multivariate methods of biostratigraphic data analysis, environmental reconstruction. Application of environmental reconstruction: detection of human impact: industrialisation, changes in watersheds, climate change.

Educational goal of subject - Competencies:
Students who complete the course will learn the basics of historical environmental reconstruction. They will learn and be able to identify large-scale environmental changes, acquire the state-of-the-art techniques used in environmental reconstruction, and be able to integrate their knowledge into the development of appropriate water management and the National Water Strategy. The knowledge gained in this course will provide students with a basis for future research on water management.

Required readings:

Berglund, B.E. (ed.) 2003: Handbook of Holocene Palaeoecology and Palaeohydrology. – The Blackburn Press, 869 pp.

Cohen, A.S. 2003: Paleolimnology: The History and Evolution of Lake Systems. – Oxford University Press, 528 pp.

Smol, J.P. 2008: Pollution of Lakes and Rivers. A Paleoenvironmental Perspective 2nd edition. – Blackwell Publishing, 384 pp.

Recommended readings:

Tracking Environmental Change Using Lake Sediments. Volume 1-5: Developments in Paleoenvironmental Research. Kluwer Academic Publishers New York, Boston, Dordrecht, London, Moscow.

Szeroczyńska, K., Sarmaja-Korjonen, K., 2007. Atlas of subfossil Cladocera from Central and Northern Europe. Friends of Lower Vistula Society, Swiecie.

Responsible for course (name, position, scientific degree): Dr. János Korponai PhD

Other teachers (name, position, scientific degree): -