Course 1: Disaster Management Workflow & Risk Mitigation: Systemic Approach

Responsible partner: CIT

Lectures:

1. Introduction to disaster management and the architecture of AYDES
2. Incident Management
3. Preparation for response
4. Response
5. Case study
6. Planning
7. Resource management
8. Recovery

This course introduces disaster management as a structured and interconnected system of workflows, processes, decisions, and coordinated actions covering the entire disaster lifecycle. The course provides learners with a systemic understanding of how disaster management functions across the phases of mitigation, preparedness, response, and recovery, and how risks can be reduced through integrated planning, coordination, and operational management. The course explores disaster management workflows from both organisational and technological perspectives, focusing on the relationships between actors, processes, information flows, and decision points within complex disaster management environments. Key themes include risk mitigation strategies, incident management, crisis coordination, operational planning, lifecycle mapping, process decomposition, integrated management systems, and the role of digitalisation in improving disaster response efficiency. Particular attention is given to systemic approaches that connect monitoring, communication, decision-making, and operational actions into one coherent disaster management framework. The learning approach combines structured lectures, workflow modelling, case-study analysis, scenario-based exercises, and collaborative discussions. Learners analyse real disaster events and map actions, decisions, and dependencies across the disaster lifecycle in order to understand how disaster management systems operate under dynamic and uncertain conditions. The course also introduces process-oriented thinking and system-level analysis before the application of more advanced technological solutions such as AI, IoT, and distributed decision-support systems. The course develops competences in disaster workflow analysis, risk mitigation planning, systems thinking, process modelling, and integrated coordination. Within the SUDEM curriculum, the course provides the operational and conceptual foundation for understanding how disaster management systems function as interconnected System-of-Systems environments and how structured workflows support effective disaster preparedness, response, and recovery.

Course 2: Disaster Monitoring: System of Systems; Subsystems, Interrelations

Responsible partner: SRTI

This course introduces disaster monitoring as a complex System-of-Systems (SoS) environment integrating space, aerial, ground-based, communication, and information systems for disaster prevention, detection, monitoring, response, and recovery. The course explores how interconnected monitoring subsystems interact to provide operational situational awareness, early warning, and decision-support capabilities in the context of natural and technological disasters. The course examines the structure, composition, and operation of aerospace and remote sensing systems used for disaster monitoring, including satellites, microsatellites, unmanned aerial vehicles (UAVs), sensors, geographic information systems (GIS), communication systems, and integrated data-processing environments. Particular attention is given to system interrelations, data fusion, monitoring architectures, subsystem coordination, and the role of real-time information exchange in supporting disaster management activities. The concept of System-of-Systems is introduced through principles such as hierarchy, feedback, openness, emergence, interconnectivity, and self-organisation. The course also addresses environmental monitoring, critical infrastructure protection, climate-related risks, flood monitoring, oil pollution detection, UAV-supported surveillance, and aerospace systems for disaster management. Learners explore practical examples of integrated monitoring systems combining satellite, aviation, and ground-level observations for operational disaster management and national security applications. The learning approach combines lectures, simulations, seminars, case studies, modelling exercises, and collaborative analysis of monitoring workflows and aerospace architectures. Learners engage with scenario-based activities involving UAV operation models, data-processing chains, GIS-supported monitoring systems, and real-world monitoring cases related to floods, environmental hazards, and critical infrastructure protection. The course develops competences in systems thinking, remote sensing, disaster monitoring architectures, situational awareness, integrated data analysis, and interdisciplinary coordination. Within the SUDEM curriculum, the course provides the monitoring and sensing foundation that supports later modules focused on IoT, edge computing, AI-driven analysis, and distributed decision-making systems.

Course 3: Data-driven decision-making support

Responsible partner: CIT

This course explores how data, analytics, modelling, and decision-support systems can improve disaster-management planning, coordination, and operational response under uncertain and rapidly evolving conditions. The course introduces data-driven approaches for transforming heterogeneous information streams into actionable knowledge that supports risk assessment, situational awareness, resource allocation, forecasting, and coordinated decision-making throughout the disaster-management lifecycle. The course examines the role of data in modern disaster-management environments integrating monitoring systems, IoT infrastructures, GIS platforms, remote sensing technologies, AI-supported analytics, and distributed information systems. Learners explore how structured and unstructured data from sensors, UAVs, satellites, emergency-response systems, environmental monitoring networks, and operational databases can be processed, analysed, visualised, and interpreted to support strategic and operational decisions in disaster scenarios. Key themes include decision-support systems, disaster analytics, risk modelling, predictive analysis, data integration, performance indicators, resource prioritisation, uncertainty management, simulation-based evaluation, and evidence-based operational planning. Particular attention is given to the relationship between data quality, timeliness, interoperability, and decision reliability in complex disaster-management environments. The course also examines the use of analytical frameworks and modelling approaches for evaluating response alternatives, assessing disaster impacts, forecasting risks, and supporting coordination between multiple operational actors and agencies. The learning approach combines lectures, data-analysis exercises, case studies, scenario-based simulations, and collaborative discussions focused on disaster-management decision processes. Learners engage with practical activities involving disaster-data interpretation, workflow analysis, decision modelling, resource-allocation scenarios, and evaluation of operational outcomes using performance metrics and analytical indicators. Scenario-based exercises demonstrate how data-driven methods support faster, more informed, and more coordinated disaster-response decisions. The course develops competences in disaster-data analysis, analytical reasoning, decision-support modelling, risk evaluation, performance assessment, and evidence-based operational planning. Within the SUDEM curriculum, the course provides the analytical decision-support layer connecting monitoring systems, IoT infrastructures, AI-supported automation, distributed coordination systems, and operational disaster-management workflows.

Course 4: IoT Principles

Responsible partner: HSO

This course introduces the fundamental principles, architectures, communication mechanisms, and operational concepts of the Internet of Things (IoT) as a technological foundation for modern digital and cyber-physical systems. The course explores how interconnected sensors, devices, networks, platforms, and intelligent services interact to enable real-time monitoring, automation, data exchange, and adaptive system behaviour across diverse application domains, including disaster management and critical infrastructure protection. The course covers the evolution of IoT from traditional machine-to-machine (M2M) communication toward Artificial Intelligence of Things (AIoT), emphasizing the increasing integration of sensing, connectivity, data processing, and intelligent control mechanisms. Key themes include IoT architectures, layered communication models, protocol stacks, interoperability, semantic integration, distributed system organisation, edge–fog–cloud processing, network management, and secure communication principles. Learners are introduced to IoT communication technologies and protocols such as IPv6, 6LoWPAN, MQTT, CoAP, Bluetooth LE, LoRaWAN, NB-IoT, and 5G-based IoT systems, as well as the role of semantic interoperability and data models in enabling scalable and cross-domain system integration. Particular attention is given to the relationship between IoT architectures and modern distributed intelligence, including edge computing, AI-enabled systems, and System-of-Systems environments. The course also examines the challenges of interoperability, scalability, resilience, cybersecurity, energy efficiency, and governance in large-scale IoT deployments. Semantic models, ontologies, and knowledge hierarchies are explored as mechanisms for enabling meaningful data interpretation and automated decision support across heterogeneous systems. The learning approach combines lectures, architecture analysis, protocol-stack exploration, case studies, and scenario-based discussions focused on real-world IoT applications in industry, smart infrastructure, environmental monitoring, and disaster management. Learners engage with conceptual modelling exercises and system-level analysis of distributed IoT ecosystems and communication workflows. The course develops competences in IoT system design, communication architecture analysis, interoperability management, distributed sensing and connectivity, and technology-supported system integration. Within the SUDEM curriculum, the course provides the technological and architectural foundation for later modules focused on IoT-enabled disaster management, edge computing, AI-driven automation, and distributed decision-support systems.

Course 5: IoT in disaster monitoring and response management

Responsible partner: WUNU

Lectures:

1. Introduction to IoT for disaster monitoring

2. Basics of image processing for disaster management

3. Object detection and classification in disaster scenarios

4. Thermal and multispectral image analysis

5. Integration of image processing into IoT systems

This course explores the practical integration of Internet of Things (IoT), image processing, computer vision, and edge computing technologies for real-time disaster monitoring and response management. Building on the foundational IoT concepts introduced in previous modules, the course focuses on the development of intelligent monitoring systems capable of collecting, processing, analysing, and transmitting operational data from disaster-affected environments. The course introduces IoT-based disaster monitoring architectures integrating environmental sensors, RGB and thermal cameras, UAV platforms, embedded edge devices, and communication networks. Particular attention is given to image processing workflows, object detection, thermal and multispectral image analysis, and AI-supported monitoring techniques used for identifying hazards, survivors, damaged infrastructure, fire fronts, floods, and other critical events. Learners explore how visual information, sensor telemetry, and automated analysis pipelines can be combined into integrated situational-awareness systems supporting emergency responders and disaster-management authorities. Key themes include image preprocessing and enhancement, segmentation, edge detection, object classification, deep learning-based object detection models such as YOLO, thermal hotspot analysis, multispectral sensing, sensor fusion, edge computing architectures, and real-time IoT dashboards. The course also examines the operational challenges of bandwidth limitations, latency, interoperability, energy efficiency, scalability, and secure communication in disaster environments. The learning approach combines lectures, laboratory exercises, simulations, and hands-on practical tasks involving Raspberry Pi-based IoT nodes, environmental sensors, UAV imagery, OpenCV-based image processing pipelines, thermal analysis, and AI-powered object detection. Learners engage in the development of edge-based disaster-monitoring prototypes integrating visual data analysis with IoT telemetry and web-based monitoring dashboards. The course develops competences in IoT system integration, disaster-oriented image processing, real-time monitoring architectures, edge-based analytics, AI-assisted situational awareness, and interdisciplinary disaster technology deployment. Within the SUDEM curriculum, the course provides the practical technological bridge between IoT infrastructure, monitoring systems, AI-driven analysis, and operational disaster-response workflows.

Course 6: Disaster Risk Management with AI Transforming current processes towards full automation

Responsible partner: CIT

Lectures:

1. Introduction to automation and automation of disaster management

2. Introduction to Domain-Driven-Design

3. Introduction to Domain-Driven-Design (Continued)

4. Challenges in architecture design

5. Challenges in architecture design (Continued)

6. Requirement elicitation

7. Requirement elicitation (Continued)

8. Disaster management architecture

This course explores how Artificial Intelligence (AI), workflow automation, and advanced software architectures can transform disaster management systems from partially digitalised operations toward intelligent, adaptive, and highly automated emergency-management environments. The course examines how automation can improve the efficiency, effectiveness, scalability, and responsiveness of disaster management workflows throughout the entire disaster lifecycle. The course introduces the core principles of automation, digital transformation, and AI-supported workflow management, focusing on disaster-awareness systems, situation detection, resource allocation, intervention scheduling, and operational coordination. Learners explore domain-driven design (DDD) as a methodology for modelling complex disaster-management environments and structuring intelligent software architectures capable of integrating heterogeneous data sources, operational workflows, and distributed decision-support mechanisms. Key themes include workflow automation, system architecture design, modularisation, requirement elicitation, interoperability, quality trade-offs, AI integration challenges, and disaster-management architecture modelling. The course also examines the role of data fusion, UAV-supported situational awareness, GIS-integrated digital twins, event-driven systems, and intelligent emergency-control architectures for improving disaster response efficiency and operational resilience. Learners are introduced to concepts such as automated event detection, resource optimisation, KPI-based emergency management evaluation, distributed digital twins, and AI-supported control systems for disaster operations. The learning approach combines lectures, architectural modelling, workflow analysis, case studies, and scenario-based discussions focused on transforming existing disaster-management systems into intelligent and automated operational ecosystems. Learners engage with requirement-engineering exercises, disaster-management architecture analysis, and conceptual modelling activities involving AI-supported decision-making, data fusion, and distributed emergency-management workflows. The course develops competences in AI-supported disaster management, workflow automation, software architecture analysis, requirement engineering, systems modelling, and intelligent operational coordination. Within the SUDEM curriculum, the course provides the advanced conceptual and architectural foundation connecting monitoring systems, IoT infrastructures, edge computing, AI-driven analytics, and automated disaster-response operations.

Course 7: Multi-Agent Decision making process

Responsible partner: CIT

Lectures:

1. Digital Twins for Disaster Management: Mitigating Structural Obstacles in the Response Pipeline

2. Digital Twins for Disaster Management (Continued)

3. Reducing errors in disaster management data with digital-twin architecture

4. Reducing errors in disaster management data (Continued)

5. Cooperative demand generation agents in a systems of systems architecture

6. Cooperative demand generation agents (Continued)

7. Optimization-driven response twins for autonomous and coordinated control

8. Optimization-driven response twins (Continued)

This course introduces advanced disaster-management architectures based on multi-agent systems, digital twins, machine learning, and System-of-Systems (SoS) engineering. The course explores how distributed intelligent agents, autonomous coordination mechanisms, and digital-twin technologies can improve disaster-response efficiency, scalability, adaptability, and operational resilience under dynamic and uncertain disaster conditions. The course examines disaster management as a distributed, concurrent, and multi-objective operational environment in which sensing systems, emergency-response units, communication infrastructures, monitoring platforms, and decision-support components must cooperate continuously in real time. Learners explore the limitations of traditional centralized disaster-management systems and investigate how agent-based and SoS architectures can support decentralized coordination, adaptive control, intelligent resource allocation, and runtime optimisation. Key themes include digital-twin architecture, descriptive–predictive–prescriptive modelling, workflow bottlenecks, demand-generation agents, coordination agents, response twins, optimizer twins, machine-learning integration, KPI-driven performance monitoring, and adaptive runtime optimisation. Particular attention is given to reducing data-related errors in disaster-management systems through digital-twin verification and model-checking techniques, enabling more reliable situational awareness and operational control. The course also examines multi-objective optimisation approaches balancing response time, responder safety, infrastructure protection, ethical constraints, workload distribution, and risk management within autonomous disaster-response systems. Learners are introduced to agent-based computational models, fuzzy reasoning, distributed coordination mechanisms, event-driven communication, machine-learning-supported adaptation, and scalable SoS runtime architectures. The course analyses how autonomous agents and digital twins can cooperate to monitor evolving disaster situations, generate resource demands, optimise operational workflows, and coordinate distributed response units under rapidly changing conditions. The learning approach combines lectures, systems analysis, architecture modelling, case studies, and scenario-based discussions focused on intelligent disaster-response coordination and adaptive operational control. Learners engage with conceptual models of distributed disaster-management architectures and examine the integration of AI, digital twins, optimisation mechanisms, and autonomous coordination within real-world emergency-management systems. The course develops competences in multi-agent system design, digital-twin architectures, distributed coordination, adaptive disaster-response control, systems-of-systems engineering, AI-supported optimisation, and intelligent operational management. Within the SUDEM curriculum, the course represents the advanced orchestration and autonomous decision-making layer connecting monitoring systems, IoT infrastructures, AI automation, edge computing, and resilient disaster-response operations.

Course 8: Edge Computing

Responsible partner: HSO

This course explores the principles, architectures, and operational role of edge computing in modern disaster-management systems, focusing on real-time data processing, low-latency analytics, distributed intelligence, and resilient system operation in dynamic and resource-constrained environments. The course examines how edge computing enables disaster-management systems to process data closer to the source, improving responsiveness, reliability, autonomy, and operational continuity during emergencies and infrastructure disruptions. The course introduces edge computing as a distributed computing paradigm positioned between sensing infrastructures and centralized cloud platforms within IoT-enabled disaster-management ecosystems. Learners explore how edge devices, gateways, local processing nodes, embedded systems, and distributed communication infrastructures support real-time monitoring, local analytics, AI-assisted processing, and rapid operational decision-making in disaster scenarios where bandwidth, connectivity, energy availability, and latency constraints are critical. Key themes include edge-computing architectures, distributed processing models, low-latency analytics, real-time data pipelines, edge–cloud integration, workload distribution, resource optimisation, edge AI, scalability, interoperability, resilience, and fault tolerance. Particular attention is given to the integration of edge computing with IoT systems, UAV platforms, sensor networks, AI-supported monitoring systems, and distributed disaster-response architectures. The course also examines the operational challenges of communication disruptions, intermittent connectivity, cybersecurity, energy constraints, and system reliability in disaster-affected environments. The learning approach combines lectures, architecture analysis, system-modelling exercises, case studies, and scenario-based discussions focused on real-time disaster-management operations. Learners engage with conceptual and practical activities involving edge-processing workflows, distributed sensing architectures, latency-sensitive system design, local AI processing, and integration of edge devices with IoT monitoring infrastructures and cloud-based disaster-management systems. The course develops competences in edge-computing architecture analysis, distributed system design, real-time data processing, edge–cloud integration, latency-aware operational planning, and resilient disaster-management infrastructure development. Within the SUDEM curriculum, the course provides the distributed processing and operational intelligence layer connecting IoT sensing systems, AI-driven analytics, monitoring infrastructures, and coordinated disaster-response operations requiring fast, reliable, and adaptive local decision support.

Course 9: System Resilience

Responsible partner: WUNU

Lectures:

1. Introduction to system resilience in disaster management

2. Measurement and evaluation of resilience

3. Fundamentals of cyber resilience in disaster management systems

4. Strategic principles of cyber resilience in disaster management systems

5. Structural principles of cyber resilience

6. Cyber resilience metrics: measures of effectiveness and evaluation

The course combines theoretical foundations, international standards, practical exercises, case studies, resilience metrics analysis, cyber-risk assessment, and scenario-based activities focused on ensuring continuity and operational reliability of disaster-management systems under cyber and physical disruptions. Students study resilience concepts across technical, organisational, behavioural, and community levels, including critical infrastructure resilience, preparedness, recovery, adaptation, and continuous improvement processes. The course introduces modern cyber resilience frameworks and standards including NIST SP 800-160, NIST CSF 2.0, MITRE Cyber Resiliency

Engineering Framework (CREF), ISO 22301, ISO/IEC 27001, ENISA resilience guidance, and disaster recovery and incident-response methodologies. Students analyse real-world cyber incidents affecting critical infrastructure and emergency-management systems, including attacks against emergency communications, energy infrastructure, and disaster-detection networks. Practical activities include cyber resilience analysis of disaster-management systems using the MITRE CREF Navigator, cyberattack modelling with STRIDE and MITRE ATT&CK methodologies, structured cyber-risk assessment exercises for emergency-management systems, resilience metrics evaluation, incident-response planning, and disaster recovery planning. Students work with realistic architectures involving sensors, gateways, processing servers, operator workstations, communication channels, SIEM monitoring, redundancy and failover mechanisms, segmentation models, and disaster recovery workflows. Special attention is devoted to structural and strategic cyber resilience principles, including defence-in-depth, segmentation and isolation, attack surface minimization, least privilege, redundancy and duplication, monitoring and logging, data integrity and authenticity protection, security culture, continuous improvement, and business continuity integration. Students evaluate resilience metrics such as MTBF, MTTR, RTO, RPO, availability, false alarm rates, response times, preparedness indicators, and behavioural resilience indicators for disaster-detection and emergency-warning systems. The course develops competences in resilience engineering, cyber resilience governance, disaster recovery planning, continuity management, resilience metrics and evaluation, cyber-risk assessment, critical infrastructure protection, incident response, security culture development, and adaptive disaster-management system design. Within the SUDEM curriculum, the course provides the resilience and continuity layer that ensures the long-term reliability, adaptability, trustworthiness, and sustainability of intelligent disaster-management systems operating under uncertain, cascading, and rapidly evolving crisis conditions.

Course 10: SUDEM train-the-trainer course

Responsible partner: SRTI

The SUDEM Train-the-Trainers (TtT) course prepares educators, trainers, and facilitators to deliver the SUDEM curriculum as an integrated interdisciplinary System-of-Systems learning programme for disaster management. The course provides pedagogical, methodological, and organisational guidance for teaching the full SUDEM framework across Higher Education (HED) and Lifelong Learning (LLL) environments. The course introduces the structure, objectives, competences, and interdependencies of all SUDEM modules, covering disaster workflows, monitoring systems, IoT architectures, edge computing, artificial intelligence, multi-agent systems, resilience engineering, nuclear safety, and digital decision-support systems. Trainers learn how individual modules contribute to different phases of the disaster-management lifecycle, including mitigation, preparedness, response, recovery, and continuous improvement. A central focus of the course is the integration of modules into a coherent disaster-management workflow using shared scenarios, interdisciplinary teaching approaches, and system-oriented learning strategies. The course emphasises scenario-based teaching, practical exercises, case-based learning, workflow modelling, and interactive classroom methods that connect sensing, data processing, interpretation, decision-making, operational response, and resilience evaluation. The course demonstrates how digital technologies—including AI, IoT, UAV systems, edge computing, sensor integration, geospatial systems, and resilience analytics—can be taught as interconnected components of modern disaster-management ecosystems. Trainers learn how to explain technical interdependencies between communication systems, monitoring infrastructures, intelligent decision-support tools, and operational coordination layers. Practical activities include curriculum integration exercises, interdisciplinary scenario analysis, mapping of learning outcomes to disaster-management workflows, adaptation of teaching materials for different learner groups, development of practical training sessions, and evaluation of teaching effectiveness through feedback and assessment mechanisms. The course also introduces methods for structuring lectures, combining readings with hands-on exercises, facilitating collaborative learning, and connecting theoretical concepts to real operational scenarios. The course develops competences in interdisciplinary curriculum delivery, system-based teaching, scenario-based instruction, digital disaster-management education, practical training design, learner engagement, and curriculum adaptation for diverse educational contexts. Within the SUDEM framework, the TtT course functions as the integrative pedagogical layer that enables sustainable dissemination, long-term curriculum scalability, and coherent implementation of the entire SUDEM educational ecosystem.

Course 11: Nuclear safety and disaster management

Responsible partner: LULS

This course examines the application of disaster-management principles within nuclear and radiological emergency environments, focusing on high-risk scenarios involving nuclear power plants, radiation incidents, armed conflict, radioactive contamination, and critical infrastructure protection. The course provides learners with a multidisciplinary understanding of nuclear safety, radiation hazards, emergency preparedness, population protection, evacuation planning, tactical response, and long-term recovery under complex and high-consequence disaster conditions. The course introduces the current state of global nuclear energy, the historical development of nuclear and radiation threats, international nuclear accidents classified under the INES scale, and the geopolitical dimensions of nuclear safety and security. Learners analyse historical nuclear incidents including Chornobyl, Fukushima, Three Mile Island, Mayak, and other major radiation accidents, examining their technical, organisational, environmental, and societal consequences. Particular attention is given to the increasing risks associated with military conflict, terrorism, critical infrastructure vulnerability, and radiation threats in Ukraine and globally. Key themes include radiation physics and hazards, nuclear safety culture, radiation monitoring, GIS-supported disaster management, intelligent data analysis, emergency response algorithms, tactical medicine, population protection, shelters, evacuation planning, decontamination procedures, and disaster management under martial law and armed conflict conditions. The course also examines innovative approaches to disaster classification, risk assessment methodologies, safety indices, and the integration of AI, geoinformation systems, and intelligent analytics into radiation-risk management and emergency-response operations. The learning approach combines lectures, historical case studies, risk-analysis exercises, scenario-based discussions, evacuation-planning activities, radiation-protection procedures, and evaluation of emergency-management strategies for nuclear and radiological incidents. Learners engage with radiation-risk matrices, safety indicators, protection algorithms, crisis-management workflows, and practical approaches for ensuring continuity of operations and civilian protection under high-risk disaster conditions. The course develops competences in nuclear and radiation safety, emergency preparedness, crisis coordination, radiation protection, tactical medicine, evacuation management, risk analysis, resilience planning, and intelligent disaster-management integration for high-risk environments. Within the SUDEM curriculum, the course provides the specialised high-consequence application domain demonstrating how monitoring systems, AI-supported analytics, workflows, resilience engineering, and coordinated decision-making operate under extreme safety, regulatory, and operational constraints.

Course 12: Disaster Management: Interdisciplinarity & Future

Responsible partner: SRTI

Lectures:

1. UAS as a danger for critical infrastructure

2. UAS for Disaster Management of Critical Infrastructure

3. Floods - New Understanding as a Result of Climate Change

4. Early Age Interdisciplinary Education and Training Towards Disaster Management

5. UAS Applications in Disaster Prediction, Dangers Monitoring, Rescue Preparation and Management

6. Tangible Heritage in Risk of Disasters

7. AI and UAS for Preventing and Managing Disasters and Reducing Their Consequences for the Built Heritage

8. Train-the-Trainers in the SUDEM Context: Methodology and Focus

This course explores disaster management as an interdisciplinary and future-oriented field shaped by technological innovation, climate change, critical infrastructure protection, education, and societal resilience. The course examines how emerging risks and rapidly evolving technologies influence disaster prevention, monitoring, preparedness, response, and recovery processes in increasingly complex environments. Particular attention is given to the role of Unmanned Aerial Systems (UAS), Artificial Intelligence (AI), digitalisation, and collaborative learning approaches in modern disaster management systems. The course addresses the growing impact of climate change on disaster dynamics, including floods and other large-scale hazards, and explores the need for integrated and adaptive management strategies. It also highlights the importance of protecting critical infrastructure and cultural heritage exposed to natural and human-induced risks. The course includes lectures on UAS applications in disaster prediction, monitoring, rescue preparation, and emergency response management, as well as the use of AI-supported systems for reducing disaster consequences. In addition, the course examines interdisciplinary education and training models, including Train-the-Trainers methodologies, collaborative learning, and knowledge co-creation within the SUDEM framework. The learning approach combines lectures, case studies, scenario-based analysis, and interdisciplinary discussions. Learners are encouraged to integrate knowledge from multiple domains and contribute their own professional and academic perspectives to collaborative problem-solving activities. The course develops competences in interdisciplinary analysis, strategic and future-oriented thinking, technology-supported disaster management, and integrated risk assessment. Within the SUDEM curriculum, the course provides a conceptual and methodological foundation for understanding the future evolution of disaster management systems and their relationship with society, technology, infrastructure, and education.

Course 13: Disaster events & management: types and principles

Responsible partner: SRTI

This course introduces the fundamental principles of disaster events and disaster management, providing learners with a broad understanding of natural, technological, and complex hazards and their impact on society, infrastructure, and the environment. The course explores the characteristics, causes, dynamics, and consequences of different disaster types, as well as the principles and processes used to prevent, monitor, manage, and recover from disaster situations. The course covers a wide range of disaster events, including floods, geological disasters, avalanches, cosmic hazards, industrial and infrastructure-related incidents, and climate-related extreme events. Particular attention is given to flood risk management, hazard phenomenology, early warning systems, risk assessment, prevention strategies, emergency response, recovery actions, and the role of legal and institutional frameworks in disaster preparedness and protection. Real-world case studies, including major disaster events in Bulgaria, are used to analyse the interaction between natural hazards, human activity, infrastructure, environmental degradation, and governance decisions. The learning approach combines lectures, simulations, multimedia resources, practical exercises, case-study analysis, and collaborative discussions. Learners engage with scenario-based activities focused on disaster prediction, monitoring, risk analysis, preparedness planning, evacuation procedures, recovery measures, and the use of digital tools and databases in disaster management. The course develops competences in hazard identification, disaster risk analysis, interdisciplinary problem solving, and integrated disaster management planning. Within the SUDEM curriculum, the course provides the foundational understanding of disaster types, management principles, and disaster lifecycle processes required for the more advanced technological, analytical, and system-oriented modules.