

ASEM-Advanced Safety Engineering & Management

ASEM 601. ASEM Seminar. 0 Hours.

Seminar focusing on student research and guest presentations of various topics of interest to safety and risk management engineers and safety professionals.

ASEM 610. Introduction to System Safety - Prevention through Design. 3 Hours.

This course sets the foundation for the ASEM program by providing an overview of all major topic areas and an introduction to many of the tools and approaches to system safety, management systems, and human factors. Topics of inquiry include the processes of hazard analysis and risk assessment, error and error-provocative environments, drift, ISO 45001, systems thinking, prevention through design, and decision making. Course content is presented in a research-to-practice format where students apply course content to their own business environment and bring their organization into the classroom. Guest lecturers from diverse backgrounds will discuss their experiences in managing safety in the workplace. Participation in periodic live dialogues is required. The course must be taken during the first semester.

ASEM 611. Hazard Analysis and Waste Elimination. 3 Hours.

Hazards have the potential to cause harm to people, planet, and profits. Hazard analysis is a process that begins with the identification of a hazard and proceeds into an estimate of the severity of harm or damage that could result if the potential is realized and a hazard-related incident occurs (ASSE TR-Z790.001 – 2009). This course examines engineering techniques utilized to systematically and logically identify and analyze hazards in the workplace. These techniques include preliminary hazard list (PHL), preliminary hazard analysis (PHA), and Operating and Support Hazard Analysis (O&SHA). Students work in teams to use the PHA to retrospectively analyze a real-world disaster. Additionally, many hazard analysis processes ultimately end up assigning blame or finding human error as a cause of hazards and accidents. The 5 Principles of Human Performance will be introduced to help students understand how people are a vital part of the system. Students will apply these 5 principles to their team PHA project and to an Individual O&SHA project.

Prerequisites: ASEM 610 [Min Grade: B]

ASEM 612. Engineering Risk. 3 Hours.

Engineering risk is defined both quantitatively and qualitatively as an estimate of the probability that a hazard-related incident will occur and of the severity of harm or damage that could result. This course provides students with tools to assess and reduce safety risks in their own company. These tools include risk assessment matrices, probabilistic risk assessment (PRA) measures, including event tree analysis, fault tree analysis, and other prevention through design concepts. The role of a structured, formalized decision analysis process in preventing serious injuries and fatalities is also explored. Students engage in a risk mitigation decision analysis project, which is specific to their company and/or business sector. Guest lecturers from diverse industries discuss their experiences in assessing and managing risk. Live participation in a weekly 1.5 hour online forum is required.

Prerequisites: ASEM 611 [Min Grade: B]

ASEM 613. Human Performance and Engineering Design. 3 Hours.

Companies can miss important opportunities to eliminate waste if they rely primarily on training to prevent human error. This course explores the historical perspective on human error and serious injury. The course material will provide a solid understanding of the principles of occupational biomechanics and human tolerance to injury with focus on human anthropometry and mechanical work capacity. This course also includes studies of human reliability, static analysis of systems in equilibrium and mechanical systems, design and performance. Due to the quantity of back related injuries and related lost time in the workplace, back pain and injury is studied along with the effect of vibration on the human body. Real-world case studies provide for application of the engineering hierarchy of controls: hazard elimination, hazard substitution, engineering controls, warnings, administrative behavior controls, and personal protective equipment. The course also examines the design aspects of ergonomics, the biomechanical engineering basis of injury prevention, and the long-term economic consequences of seemingly minor injuries. In semester projects, students perform incident investigations using biomechanical and other data. After gathering and analyzing data to determine injury causation, they will identify and re-design error-provocative environments in their own workplaces. Guest lecturers from diverse backgrounds will discuss their experiences with human performance and/or biomechanics. Live participation in a weekly 1.5 hour online forum is required.

Prerequisites: ASEM 610 [Min Grade: B]

ASEM 614. Engineering Ethics and Acceptable Risk. 3 Hours.

This course explores the economic, social, and political consequences of safety risk and considers provocative real-world dilemmas: What is acceptable risk? Are the fundamental canons of engineering ethics and safety ethics contrary to the concept of acceptable risk? What is the worth of human life? Students will conduct critical reviews of corporate safety and ethics policies from their own company. Real-world case studies provide the framework for exercises and are used throughout course discussion boards, assignments, and dialogues. Participation in periodic live dialogue is required.

Prerequisites: ASEM 610 [Min Grade: B](Can be taken Concurrently)

ASEM 615. Leading through Climates of Change. 3 Hours.

All progressive companies are moving toward greater sustainability - protecting people, planet, and profits. To guide their companies through these changes and integrate safety into the priorities at the executive level, safety engineers and professionals must have strong leadership skills. This course explores engineering leadership best practices, including the eight steps of transformational leadership - creating a sense of urgency, creating a guiding coalition, developing a vision and strategies, communicating the vision, empowering broad-based action, generating short term wins, consolidating gains and anchoring the culture. This course also explores the concept of Resilience Engineering and helps students understand the impacts of socio-technical risks. Guest lecturers from diverse industries discuss their experiences in managing change in today's global business environment. Live participation in a weekly 1.5 hour online forum is required.

Prerequisites: ASEM 610 [Min Grade: B]

ASEM 616. Policy Issues in Prevention through Design. 3 Hours.

This course provides an overview of best practices in four major policy areas: (1) cost-benefit analysis; (2) corporate culture and the "HR Department"; (3) standards, codes, and regulations; and (4) strategic alliance development. Case studies are used to illuminate both the role of engineers and other safety professionals in shaping public policy on the local, national and international levels and the ethical challenges they encounter. The significance of an organization's corporate culture in developing and implementing advanced safety management plans is also explored. Students conduct "gap analyses" of their company's policies by comparing them to best practices and identifying unintended consequences of poor safety policy in their own business and industry sector. Students will engage in discussion board posts on contemporary policy issues and participate in exercises related to federal rulemaking. Guest lecturers from diverse backgrounds will discuss their experiences with policy issues. Live participation in a weekly 1.5 hour online forum is required.

Prerequisites: ASEM 610 [Min Grade: B]

ASEM 617. Crisis Leadership. 3 Hours.

Leadership requires more than the predication, control, and management of the vast network of influences that make up our work, especially in times of crisis. By its nature, a crisis is an unpredicted event that requires sensemaking and innovation to go beyond immediate recovery, to step forward into learning. We can only do this when we value, trust, and communicate with the people in our systems. This course will explore why complex adaptive systems are different and may be understood and influenced by leadership at all levels before, during, or after a crisis. Students will assess their own organizational culture through the artifacts, espoused values, and deep assumptions and learn to shape these through relationships, sensemaking, and divergent thinking. This course includes two-week long learning modules based on a combination of written discussion boards that emphasize academic rigor, small group dialogues, network mindmapping, and dynamic online Zoom classes with the professors.

Prerequisites: ASEM 610 [Min Grade: B]

ASEM 619. Capstone Project - Part 1. 3 Hours.

This course is designed to understand how to apply many of the ASEM topics and bring to bear the competencies acquired through the program. Part of this is developing an understanding of the complex nature of human contributions. Students will be challenged to correlate learnings from the ASEM Program that lead to the creation of safer work systems and in so doing develop a concept for their capstone project.

Prerequisites: ASEM 612 [Min Grade: B] and (ASEM 613 [Min Grade: B] or ASEM 614 [Min Grade: B] or ASEM 615 [Min Grade: B] or ASEM 616 [Min Grade: B] or ASEM 617 [Min Grade: B] or ASEM 628 [Min Grade: B])(Can be taken Concurrently)

ASEM 620. Capstone Project - Part 2. 3 Hours.

Capstone Projects serve as a culminating academic and intellectual experience for students. They are an opportunity to create a multifaceted project representing what students have learned during the ASEM Program. Unique approaches to the application of theory and research are encouraged as students are tasked with developing a project that suites their needs, and interests, while simultaneously demonstrating key learnings explored in the ASEM program. Students will be challenged to develop a capstone project that demonstrates mastery of the theories, concepts, and skills learned during the ASEM program and detail how they have applied or will apply them to a real-world situation.

Prerequisites: ASEM 617 [Min Grade: B] and ASEM 619 [Min Grade: B]

ASEM 626. Learning-Based Response to Organizational Accidents and Incidents. 3 Hours.

Accident investigations are an inevitable part of most industries, yet most incident analysis is based on models that were developed many decades ago. Current research indicates that 80% of accidents are attributed to human error. Yet few tools or processes are designed to examine the context of human actions. Human interactions exist in complex systems, which are by nature unpredictable. When we look at human involvement, we find that actions are influenced by conditions extant in the system. The goal of this course is to discover the importance of dedicating time and resources to understanding why humans are integral to safety in complex systems. Students will learn both the theory and practical application of new techniques that expand the ability of organizations to learn from events. Students will explore the history of accident investigation, its influence on culture, the importance of context in the evaluation of human actions, the inclusion of complex narratives in reports, and how to present their findings to leadership and the field. Overall, students will come away with a more practical ability to help their organization learn from events. The course structure is focused on case study analysis, peer-to-peer learning and research. Questions are designed to challenge current understanding of the human contribution to accidents and why actions or decisions made sense to those involved at the time.

Prerequisites: ASEM 617 [Min Grade: B]

ASEM 627. Communication in Safety Systems. 3 Hours.

Communication plays a powerful role in creating safety in the work environment. Effective language increases communication and can lead to individual and organizational learning during safety training, real-time work, and post-mission analysis. However, the meaning of our language is not constant – it changes based on the experience of the worker, the context of the event, and the culture that surrounds the work environment. Language can become ineffective, or even damaging, when meanings differ or go unchallenged. This can occur when definitions are assumed, linguistic shortcuts are taken, or when language bias demands a singular interpretation. Engineers work with mechanical systems, which can be defined by a specific language: e.g. binary oppositions, like turning a switch 'on' or 'off'. However, engineers also work with other people and must take human factors into account, including effective communication. This is the case with safety specialists, who help create the system architecture and develop practical training for workers in risk and safety. These specialists may be expected to participate in accident investigations or incident reviews, which can be unintentionally biased by the language used, which lead away from learning opportunities.

Prerequisites: ASEM 617 [Min Grade: B]

ASEM 628. Electrical Systems Safety. 3 Hours.

There is a subset of occupational hazards characterized as low frequency, but with very high consequence (potential for catastrophic loss, fatality or permanent disabling injury). A mishap involving unintentional exposure or contact with electrical energy is one of the low frequency/high consequence exposures. We live in an electrical world, with electrical hazards embedded in nearly every aspect of daily living – at home, at work, in public places, and in recreational activities. This course explores hazards, risks and context of electrical mishaps coupled with a systems safety engineering approach to manage the risks. Course content is presented within the framework of real-world case studies from a variety of industry sectors, including, but not limited to, manufacturing, utilities, and health care and includes several guest lectures by leaders in the profession. Students apply course content to their own business environment. Live participation in a weekly 1.5 hour online forum is required.

Prerequisites: ASEM 610 [Min Grade: B]

ASEM 630. Machinery Safety Management System. 3 Hours.

Safeguarding technology and requirements has come a long way since the Industrial Revolution. Despite this progress, the lack of effective machine guarding and management has continuously been named one of OSHA's topmost-cited violations. Most businesses assume that the machine manufacturer and installer have met safety compliance requirements, but have they? Some site safety professionals use a standard general safety checklist to verify machine safety requirements but is this enough? The goal of this course is to equip the student with working knowledge of machine safety through understanding and applying key machine safety compliance standards, e.g. ANSI B11.0, ANSI B11.19, NFPA 79, and ISO 13849-1. This course will focus on and apply to power-driven machines used to produce or process material. Within the course, students will evaluate their current machine management systems to determine obstacles, best practices, and solutions to further develop their knowledge of machine technology and management. Students will conduct a machine task-based risk assessment, utilize the hierarchy of control to select risk reduction measures, and verify and test selected safeguards to mitigate risks to an acceptable level. To ensure that the machine safety management process is sustainable, students will utilize ANSI Z10 or ISO 45001 to develop a machine safety management system outline to be used at their site or within a company.

Prerequisites: ASEM 610 [Min Grade: B]

ASEM 636. Human Organizational Potential. 3 Hours.

Human Organization Potential (HOP) is one of the most popular and in demand safety programs worldwide yet relies almost exclusively on one-day dialogues to introduce workers and management to non-academic content. However, the origin of HOP has a strong academic foundation based on research and field trials. This course will examine the historical foundation and supporting academic research of HOP principles and practices. It will show the relevance of this approach to improving safety systems and creating work environments that optimize learning potential in organizations.

Prerequisites: ASEM 610 [Min Grade: C] and ASEM 617 [Min Grade: C]

ASEM 637. Applied Semiotics in Safety Systems. 3 Hours.

Semiotics is the study of how meaning is created through symbolic communication that is taken in through our senses. A sign can be anything (object, process, activity, conduct) that communicates meaning to another person, who then interprets and makes sense of the sign. The meaning may be intentionally constructed (e.g. advertisements, workplace safety signs) or unintentional (e.g. a cough and fever might be a sign of Covid). Semiotics includes the systems into which signs are organized and the social and cultural contexts where they gain relevance. This course will focus mostly on visual semiotics, as these are the ones most encountered in safety systems. The module topics will open the perception of students to the semiotics around them, help make sense of intentional and unintentional information, and empower them to communicate their knowledge to others. Course information will come from peer-reviewed academic resources which will then be practically applied by students to create positive changes in workplace semiotics.

Prerequisites: ASEM 610 [Min Grade: C] and ASEM 617 [Min Grade: C]

ASEM 640. Introduction to Model-Based Safety Assessments. 3 Hours.

This course provides students an introduction to model-based engineering and methods to assess holistic safety risks in their own company. These tools include requirements development, functional decomposition, design architecture, probabilistic risk assessment (PRA) measures, including, failure mode effects and criticality analysis (FMECA), fault tree analysis (FTA), and other safety engineering concepts. The role of a structured, formalized model-based engineering process, used to identify and mitigate hazards, is explored. Students engage in a rigorous model-based safety analysis project.

Prerequisites: ASEM 612 [Min Grade: B]

ASEM 650. AI for Workplace Safety Opportunities, Applications, and Ethical Considerations. 3 Hours.

This advanced course examines the rapidly evolving intersection of Artificial Intelligence (AI) and occupational safety, preparing safety professionals to navigate the transformative impact of AI technologies on workplace risk management. This course will provide an overview of the history of AI to include elements within AI (machine learning, deep learning, generative AI, and large language models (LLMs) etc. The course will provide examples and experiential opportunities for the students related to robotics, computer vision, virtual reality, automation, and deep learning data analysis for causation. The course will include interactive opportunities for each student to better understand how their collaboration and partnership with AI technical experts can amplify their impact on safety. And this course will teach safety professionals how to develop actual business cases to equip them with proven mechanisms to drive large scale change within their organizations using AI and other forms of advanced technology.

Prerequisites: ASEM 610 [Min Grade: C]

ASEM 651. Emerging Trends in Safety Engineering. 3 Hours.

This course explores emerging trends affecting environmental health and safety engineering functions across industries, including regulatory, societal, business, and technological developments. Participants will evaluate specific emerging trends, such as Environmental, Social, and Governance (ESG), Corporate Social Responsibility (CSR), and innovations in technology that they can expect to encounter within their organizations as well as the interactive relationships that EHS has with these trends. Lectures, group discussions, personalized feedback, and peer to peer engagement will be utilized to support learners in their development.

Prerequisites: ASEM 610 [Min Grade: C]

ASEM 652. Safety Management Systems. 3 Hours.

This course explores and supports the development of an ISO 45001 Management System throughout a participant's organization. Working through the ISO 45001 Standard step by step, participants will come to not only understand the nuances and intricacies of the standard but also have practice taking actionable steps to develop, complete, and implement in their organization. Lectures, group discussions, personalized feedback, and peer to peer engagement will be utilized to support learners in their development.

Prerequisites: ASEM 610 [Min Grade: C]

ASEM 690. Special Topics in (Area). 1-3 Hour.

Special Topics.

ASEM 691. Individual Study in (Area). 1-6 Hour.

Individual study.

ASEM 695. ASEM Journal Club. 1-3 Hour.

This course will help the student conduct research in support of identifying a research topic, conducting research associated with that topic, and ultimately preparing a research proposal and literary review.

Prerequisites: ASEM 610 [Min Grade: C]