Brief Descriptions of SH Courses

In the descriptions of courses given below, the workload for the courses is displayed in an A-B-C-D- E format where:
A – No. of lecture hours per week
B – No. of tutorial hours per week
C – No. of laboratory hours per week
D – No. of project/assignment hours per week
E – No. of hours for preparatory work per week

SH5001 Fundamentals in Process Safety
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course will provide the participants with the foundational knowledge in chemical process safety, covering the key tenents of risk-based process safety to prevent potential process safety incidents. Participants will be exposed to industry, local and international standards and practices for effective process safety management

SH5002 Fundamentals in Industrial Safety
Units: 4
Workload: 3-0-0-0-7
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course provides basic industrial and process safety knowledge for safety practitioners. It covers the life-cycle (birth-to-death principle) approach in preventing safety problems in industry. Introductory techniques to risk management such as hazard identification, risk assessment, risk evaluation and risk treatment will be covered. Concepts on system safety, inherently safe design, equipment/process reliability, redundancy and common cause failures in the prevention of industrial accidents will also be taught.

SH5003 Fundamentals in Environmental Protection
Units: 4
Workload: 3-0-0-1-7
Prerequisite(s): Nil
Preclusion(s): Students who have obtained degrees or post-graduate diplomas in Environmental Engineering, Environmental Sciences or their equivalent
Cross-listing(s): Nil
The course provides knowledge in the fundamentals in environmental protection, for practitioners in the safety, health and environment technology industry. It deals with a range of concepts including pollution prevention, properties and fate of pollutants, air pollution and water pollution control, GHG emissions and solid waste management. Residuals management will also be covered. Emphasis is placed on industrial activities and the environment.

SH5004 Fundamentals in Industrial Hygiene
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course provides basic industrial hygiene knowledge for safety, health and environment protection practitioners. It will review the chemical, physical and biological and ergonomic hazards found in the workplace and their potential effect on human health, including an introduction to toxicology. The mechanism for exposure to the hazards and methods of estimation of employee exposures will be outlined. Employee exposure monitoring, sample analysis and data analysis will be discussed. The control of hazards and exposure in the workplace by inherently health analysis, engineering, personnel controls and personal protective clothing will be discussed.

SH5005 Risk Analysis & Safety Analytics
Units: 4
Workload: 3-0-0-4-3
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course aims to equip students with a holistic view of risk and the management of occupational safety and health risk as part of enterprise risk management. Students will learn essential theoretical knowledge in risk analysis with a particular focus on SHE risk. Various risk analysis methodologies, from traditional event-chain approaches to more recent system's approach will be shared. Students will also be taught on the application of analytics to better manage SHE risks. Principles and methods of data analytics will be taught, along with application examples.

SH5101 Industrial Toxicology
Units: 4
Workload: 3-0-0-2-5
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course covers the absorption of chemicals into human bodies, their bio-transformation, excretion and adverse effects on the target organs. Other topics cover including toxicological studies and the application of toxicological information in the prevention of occupational diseases in the workplace. Students must have a chemistry background or basic understanding of chemical safety measures at the workplace.

SH5102 Occupational Ergonomics
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course covers human capability and job demands. The principles of job design and analysis, and their application in the prevention of occupational disorders arising from the mismatch worker and job will be covered. Other topics cover including anthropometry, biomechanics, work physiology and work psychology, job factors and environmental factors in occupational disorders.

SH5103 Biosafety and Biosecurity
Units: 4
Workload: 3-0-0-3-4
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course is designed to provide students with the

a) knowledge to understand the underlying principles and regulatory requirements related to biological safety and security;
b) skill to analyse the risks associated with the use and activities involving hazardous biological materials; and
c) method to design and implement effective measures to manage the biological risks.

SH5104 Occupational Health
Units: 4
Workload: 3-0-0-4-3
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course aims to provide a working knowledge to non-medical practitioners of environmental and occupational safety and health on how to identify, manage and prevent occupational health issues and how to provide occupational health services in the workplace. A wide range of topics will be covered, including general occupational health principles, assessment, management and prevention of occupational and work-related diseases and occupational health programmes.

SH5105 Noise and Other Physical Hazards
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course will cover the health effects, measurements methods, regulations, and control technologies related to common physical health hazards encountered in occupational settings. The emphasis of the course will be placed on the identification, evaluation and management of the hazards of noise, temperature extremes, extreme pressures, vibration and lighting in the industry. The hierarch of control will be used to demonstrate the strategy of reducing the risk to the level of as low as reasonably practice.

SH5106 Radiation Safety
Units: 4
Workload: 3-1-0-0-7
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course provides knowledge in the safety aspects of the application of both ionising and non-ionising radiation. The students will be equipped with the skills and knowledge necessary to comprehend the potential adverse health effects, type of exposure monitoring, engineering controls and personnel controls, to improve radiation safety. Essential topics include radiation physics, radiation detection, radiation units and radiobiology, specific applications used in medical/healthcare sector (Diagnostic, Nuclear Medicine and Radiotherapy) and industrial sector (Radiography, Nuclear Gauging, Analytical, Inspection/Screening and Sterilization); covering radiation protection in radioactive waste management, transportation and emergency response.

SH5107 Industrial Ventilation
Units: 4
Workload: 3-0-0-4-3
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
Ventilation systems used for the protection of the employee health will be studied. The design of effective ventilation systems from the capture hood, ducting, air cleaning equipment, fans and exhausts will be studied. The testing and maintenance of existing ventilation systems will be reviewed.

SH5108 Chemical Hazard Management
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course provides essential knowledge in toxic industrial chemicals (TIC) management, chemical hazards mitigation, control and management principles on chemicals usage, storage, handling, hazard and risk communication, administrative measures, transportation and disposal. Topics covered include implementation of engineering controls, administrative controls, selection, use and limitations of chemical protective ensembles such as respirators, chemical gloves and chemical protective clothings.

SH5109 Biostatistics and Epidemiology
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course provides students with fundamental concepts in statistical methods and principles necessary for understanding, interpreting data and applying biostatistical reasoning to research or workplace studies. It also introduces students to the principles, methods, and quantitative techniques building on basic concepts of epidemiology. The biostatistics component introduces statistical concepts of data presentation, data management, confidence intervals, sample size and power, descriptive statistics, correlation and regression. The epidemiology component covers study design; measures of disease frequency and association; bias, confounding and effect modification; causality. It also includes a field epidemiology component to incorporate disease investigation in the workplace and community. This course does not focus on computing skills, but instead on the interpretation of data from studies and the appropriate application of study design and analysis methods.

SH5110 Chemical Hazard Evaluation
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course provides essential concepts and techniques related to the evaluation of occupational exposure to gases, vapors, and aerosols. Topics covered include air flow measurements, aerosol science, particulate sampling with and without size separation, optical microscopy, active and passive sampling of gases and vapors, direct reading instruments, sampling strategy and statistical evaluation of exposure data, Singapore legislative and international guidelines on occupational exposure limits and threshold limit values.

SH5201 Process Hazard Analysis
Units: 4
Workload: 3-0-0-3-4
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course provides the essential concepts, methodologies, tools and techniques for effective process hazard analysis. Topics covered include the various approaches to conducting process hazard analysis and the use of hazard identification tools and and evaluation techniques such as Hazard and Operability (HAZOP) Analysis, What-if Analysis (WIA), Failure Modes and Effects Analysis (FMEA), Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Bowtie Analysis and the Layer of Protection Analysis (LOPA) methodology.

SH5202 Quantified Risk Analysis
Units: 4
Workload: 3-0-0-0-7
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course will cover: Hazard evaluation, frequency and probability, probit concept, logic diagrams, failure rate data, FAR concept and criteria of acceptability, assessment of individual and societal risk. Source term estimation. Fire and explosion. Vapour, liquid and two phase release rate models. Hazard analysis case study, hazard control and mitigation. Atmospheric dispersion modelling, puff, plume and dense gas models. Consequence assessment of release, flammable and toxic releases, vapour cloud explosion, BLEVE. Radiant heat flux, blast and missile.

SH5203 Resilience and Emergency Planning
Units: 4
Workload: 3-0-0-0-7
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course provides the fundamentals of resilience and emergency planning, essential for capacity planning to build organizational resilience and emergency preparedness. Key aspects covered include enterprise resilience management framework, crisis and business continuity planning considerations, scenario and pre-incident planning approaches, and emergency response planning parameters to manage potential emergency incidents from the complex process industry (chemical and petrochemical plants) to the conventional built environment (malls, schools, hospitals, and hotels).

SH5204 Industrial Safety Engineering
Units: 4
Workload: 3-0-0-0-7
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course provides the essentials of engineered systems and hazard controls from the early conceptual-design and construction stages, to managing and maintenance of conventional built environment (malls, schools, hospitals, and hotels), to safe operation of complex process industry (chemical and petrochemical plants). Key aspects covered include construction design for safety (DfS), design for maintainability (DfM), fall prevention and protection, lifting and material handling, inherent safer plant design, engineered mitigation and life-safety critical systems, equipment influence assessment and maintenance, alarms and safety-interlocks, safety-critical control points and safe work procedures, hazardous area and electrical equipment classifications, electrical, electrostatic and lightning protection.

SH5205 Crisis and Incident Management
Units: 4
Workload: 3-0-0-0-7
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course provides the fundamentals of crisis and incident management, essential for capacity planning to build organizational crisis and incident management capability. Key aspects covered include enterprise incident management architecture; incident command and management framework; emergency operations, mutual aid and joint operations concept; crisis response functions and incident management priorities; business continuity and recovery management considerations to manage potential incidents from the complex process industry (chemical and petrochemical plants) to the conventional built environment (malls, schools, hospitals, and hotels).

SH5206 Human Factors in Process Safety
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
An introduction to the human factors that arise from the interaction of the characteristics in the operators, organizations and facilities or equipment. Human factors influence the performance of the operators and the risk of the operators to commit human error in the industry. The course covers the identification and evaluation of these characteristics in the operators, organizations and facilities, as well as methods for preventing the human error in process safety.

SH5207 Process Safety Engineering
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course will provide the participants with the knowledge to identify Major Accident Scenarios that can give rise to consequences such as Fires, Explosions and Toxic releases. Participants will also be exposed to engineering and design guidelines based on industry, local and international standards and practices to demonstrate risk management to ALARP and prevent Major Accident Scenarios.

SH5208 Functional Safety for Process Industries
Units: 4
Workload: 3-0-0-4-3
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course aims to equip process industry professionals to understand the detailed requirements for design, realization, validation, operations, maintenance, modifications and de-commissioning of Safety Instrumented Systems (SIS) for the process industry in accordance with the requirements of Functional Safety Standards (viz. IEC 61508/ 61511).

SH5209 Process Safety Digitalization
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course will provide the participants with essential knowledge on the development and impact of digitalization on chemical process operation and safety. Process digitalization presents opportunities for better process efficiency. However, the use and dependence on data utilization and automated instrumentation can have implications on process safety. Industry, local and international standards and practices for effective process digitalization will be shared. Participants will be exposed to low-code development platform to identify Safety use cases and develop customised solution on their own to address their business needs. This course is for students pursuing MSc (SHE) Degree with specialisation in Process Safety.

SH5401 Safety, Health, Environment and Quality Management Systems
Units: 4
Workload: 3-0-0-2-5
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course provides an assessment of all the elements covered in current worldwide codes, standards, and legislature. The different models will be compared to determine overlaps and omissions. Models that will be covered in details include ISO 9001, ISO 14001, ISO 45001, OSHA Process Safety Management Rules, CCPS Technical Safety Management of Chemical Process Safety, API 750, Singapore Legislations on Safety & Health Management Systems related to the shipyard, construction, and COMAH-type chemical process industries and installations. In addition, the course will cover auditing techniques and skillsets needed to plan, lead and undertake management system auditing based on ISO 19011.

SH5402 Safety Leadership and Management Practices
Units: 4
Workload: 3-0-0-0-7
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course will provide the essentials of future-ready leadership and contemporary management practices in the evolving commercial and industrial business landscape in light of global and national drive for sustainability, sustainable business, and digital transformation in the management of safety, health and environmental issues. It covers the contemporary leadership, management theories, safety leadership, safety culture, organizational behaviour, human behaviour, motivation theories and their applications.

SH5403 Independent Study
Units: 4
Workload: 0-0-0-7-3
Prerequisite(s): Nil
Preclusion(s): SH5404
Cross-listing(s): Nil
This course involves supervised self-study over one semester on a topic approved by the Department. The work may relate to a comprehensive literature survey and critical evaluation, safety, health or environmental engineering study, industrial field study, or a combination of these. The study area is to be finalised, after consultation with the supervisor. The student has to find a suitable supervisor. The student must acquire interpret, evaluate relevant information in the area of study, and formulate a practical solution. Approval will be granted by the Program Manager. Students shall carry out the study within the semester.

SH5404 Safety Health and Environmental Project
Units: 8
Workload: 0-0-0-7-3
Prerequisite(s): Nil
Preclusion(s): SH5403
Cross-listing(s): Nil
This course involves a supervised project over two semesters, on a topic approved by the Department. The work may relate to safety design and analysis, safety engineering case study, field study, or a combination of these. The study area is to be finalised, after consultation with the supervisor. The student has to find a suitable supervisor. The student must acquire interpret, evaluate relevant information in the area of study, and formulate a practical solution. Approval will be granted by the Program Manager. Student shall carry out the project within the period of his/her candidature.

SH5405 Fire and Explosion Safety
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course will provide the participants with the essential knowledge to manage fire and explosion hazards in workplaces. Participants will be exposed to local legislative requirements, approaches in fire safety design, protection technologies, industry good practices, and key elements of an effective fire and explosion safety management program.

SH5406 Research Methodology
Units: 4
Workload: 3-0-0-4-3
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course aims to equip safety, health and environment practitioners with essential knowledge and skillset to conduct qualitative and quantitative research studies, using tools and techniques relevant to the practice.

SH5407 Sustainable Energy and Environment
Units: 4
Workload: 3-0-0-3-4
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This course is designed to provide students with: (a) an understanding of the effect of climate change and energy on sustainable development, as the world transit from fossil fuels to low carbon energy and renewable energy; (b) insights on the challenges and opportunities in achieving affordable, reliable and clean energy in major industry and transportation sectors; and (c) strategic thinking and skill-set to explore and evaluate the environmental impacts, hazards and risks associated with energy, across its value chain, from production to consumption.

SH5408 Electrical Safety
Units: 4
Workload: 3-0-0-5-2
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course will provide the participants with the essential knowledge in electrical safety associated with electrical power supply and electrical installation; including understanding of power supply & quality, basic electrical design, earthing, safety hazards in Electrical installations, and equipment handling, overcurrent and earth fault protection for all occupancy types (residential, commercial and industrial). Covering LV, HV, single-phase (230V) and 3-phase (400V) power supplies, back-up Generator power supply, and renewable energy. Participants will be exposed to local power authority's requirement (Energy Market Authority, PowerGrid etc), local and international standards and practices for effective management of electrical safety.

SH5409 Sustainability and Environmental Analysis
Units: 4
Workload: 3-0-0-3-4
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
The course is designed to explore the roles of Occupational Health and Safety professionals in driving organisation's sustainability and ESG performance. The course focuses on the transition to interpreting workplace and industrial settings in social well-being and ecological sense, considering biophysical, social, cultural, economic, human rights human health regarding industrial proposals, projects and regulatory requirements. It provides students with various reporting and environmental management tools to gain practical and theoretical knowledge. The course focuses on three toolkits to help students' capacity building on sustainability:
a) ESG and sustainability disclosure;
b) Environmental Impact Assessment;
c) Product Life Cycle Assessment;

SH5666 Industrial Safety, Health and Environment Practices
Units: 8
Workload: 0-0-0-10-10
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
This is an industrial attachment course that provides students with work attachment experience in the field of safety, health and environmental management in a company.

SH5880 Topics in Industrial Hygiene
Units: 4
Workload: 3-0-0-3-4
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
Advanced topic in Industrial Hygiene that is of current interest. The course will be conducted by NUS staff and/or visitors.

SH5881 Topics in Process Safety
Units: 4
Workload: 3-0-0-3-4
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
Advanced topic in Process Safety that is of current interest. The course will be conducted by NUS staff and/or visitors.

SH5882 Topics in Environment Protection
Units: 4
Workload: 3-0-0-3-4
Prerequisite(s): Nil
Preclusion(s): Nil
Cross-listing(s): Nil
Advanced topic in Environment Protection that is of current interest. The course will be conducted by NUS staff and/or visitors.