FACULTY OF CHEMISTRY

SUBJECT CARD

Name in Polish	Bezpieczeństwo techniczne
Name in English	Technical safety
Main field of study (if applicable):	Chemical Technology*, Chemical and Process Engineering*,Chemistry, Chemical and Process Engineering, Biotechnology
Level and form of studies:	1st level*, 2nd level – supplementary semester, full-time
Kind of subject:	obligatory
Subject code	TCC014006*, TCC024022
Group of courses	NO

	Lecture	Classes	Laboratory*	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	crediting with grade		crediting with grade		
For group of courses mark final course with (X)					
Number of ECTS points	1		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	0,5		0,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of chemistry on the secondary school level
2. Fundamental knowledge on the chemical safety
3. Skill in computer operation

SUBJECT OBJECTIVES

C1 To familiarize students with the basics of technical safety
C2 National and European law regulations related to the technical safety
C3 Learning algorithms for analysis of industrial installations hazards
C4 Teach students of the health risk assessment associated with industrial failures
C5 Familiarizing students with examples of spreading chemical pollution and with the methodology of calculations of spreading the contaminants in the environment

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEK_W01 - familiar with basic concepts and definitions of technical safety
PEK_W02 - can specify the basic legislative acts governing the national and European technical safety rules
PEK_W03 – knows the common elements of industrial operational and emergency response
PEK_W04 – familiar with the main provisions of environmental law, Seveso III directive and of the Convention on the transboundary effects of industrial accidents
PEK_W05 – able to apply methods of risk analysis to identify possible failure in industrial installations
PEK_W06 – knows how to describe the basic methods of analysis of the health risks in areas contaminated as a result of industrial accidents

relating to skills:

PEK_U01 – can use the databases in order to classify plants in terms of the risks involved
PEK_U02 – knows how to carry out an analysis of the hazards in simple industrial installations

PEK_U03 – can suggest remedial measures in the event of an industrial accident in simple chemical installations
PEK_U04 – can perform simple calculations of exposure to the contamination of the environment after the failure of industrial plant
PEK_U05 – can use the tools to model the spreading of chemical contamination
relating to social competences:
PEK_K01 – able to work in a team
PEK_K02 – feels responsible for the results of the tasks entrusted to

PROGRAM CONTENT

	Lectures	**Number of hours**
Lec 1	**Basic concepts.** The subject of technical safety, safety perception, the essence of enterprise security, basic definitions, security scopes, importance of safety as a guarantee of the existence of an entity, the risk and examples of threats to the elements of the environment. Risks for the environment. The state of insecurity, its social and economic effects. Types of security. Examples of technical failures, the analysis of the causes and effects.	2
Lec 2	**Safety-related items.** Safety features versus general security companies. Organisation and management, skills, specificity of manufacturing technology, infrastructure condition, emergency planning, internal reviews and analysis of accidents, development of safe work, organisation of operational service posts, striving for as few nuisance work. Analysis of the causes of industrial accidents. Characteristics of chemical companies, dangers, hazardous chemical substances.	2
Lec 3	**Polish and the European legislation**. Environmental law, Directive 67/548/EEC. Groups of substances and preparations considered dangerous. Explosive substances (E) oxidizing (O), extremely flammable (F+), flammable (F), flammable (R10), very toxic (T+), toxic (T), harmful (Xn), corrosive (C), irritant (Xi), sensitizing (R42 and/or R43), carcinogenic (karc..), mutagenic (Muta.), toxic to reproduction (Repr.), which are dangerous for the environment (N or/and R52, R53, R59), European Council Directive 96/82/EC, the Convention on the transboundary effects of industrial accidents, environmental law, Seveso-enterprises, non-Seveso enterprises, criteria.	2
Lec 4	**Toxic industrial agents, industrial accidents, severe crashes, industrial contamination.** Process safety. Functional safety, safety assessment map. A comprehensive evaluation of the installation process in the various phases of the realisation of the investment.	2
Lec 5	**Risk assessment methods.** Identification of potential threats. HAZard and OPerability Study (hazard and operability study), its goals, importance, specialty risks. Keywords, main and auxiliary keywords, installations, design objectives, deviations from design intent, hazards, parameter, operational problems, the experts, the process, pairs of keywords in hazards analysis.	2
Lec 6	**Examples of HAZOP analysis.** Chemical process, the analysis of installation nodes, HAZOP team of experts, the structure of the team, the team of experts work scheme, the development of HAZOP report, deviation, deviation result, the security, the action. Certification of persons carrying out safety circuits, design and service.	2
Lec 7	**The principles of contamination assessment** resulted from the industrial accidents, toxicity, carcinogenicity, principles for the risks evaluation in areas contaminated as a result of industrial accidents. Exposure-transmission path-receptor relationship. Elements of the risk assessment procedures, hazard identification, exposure assessment, dose-response identification, risk assessment, uncertainty analysis. Health risk, the risk quotient, the risk index.	2

Lec 8	Elimination of the effects of industrial accidents, environment remediation methods for the areas contaminated as a result of industrial accidents, examples. Summary. Knowledge check.	1
	Total hours	**15**
Laboratory		**Number of hours**
Lab 1	Determination of the limits of flammability and explosion of chemical substances	2
Lab 2	Determination of the effects related to the influence of toxic vapours of volatile substances resulting from industrial accidents	2
Lab 3	Analysis of explosive substances emissions and risks associated with their spread in the environment	2
Lab 4	Calculation of the level limits of toxic substances during outflow from a tank, taking into account different topography and atmospheric conditions	2
Lab 5	Analysis of risks related to the emission of toxic substances during the free evaporation from the open tank	2
Lab 6	Liquefied gas discharge from a pipeline. Hazard analysis and prevention consultation and the development of exercises.	2
Lab 7	Calculation of the migration limits of dangerous substances and their concentrations in areas with dense infrastructure	2
Lab 8	Consultations and development of laboratory reports.	1
	Total hours	**15**

TEACHING TOOLS USED

N1. Software EFFECTS 9 to calculate the potential risks arising from industrial accidents
N2. ALOHA software to calculate the effects of emissions of hazardous substances into the environment
N3. Multimedia presentations
N4. The laboratory test stand

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Learning outcomes number	Way of evaluating learning outcomes achievement
P (lecture)	PEK_W01 – PEK_W06	final test
F (laboratory)	PEK_U01 – PEK_U05	reports from the laboratory excercises

P1 (laboratory) = (F1+F2+F3+F4+F5+F6)/6

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] M.Ryng, Bezpieczenstwo techniczne w przemsle chemicznym , WNT Warszawa 1985
[2] Praca zbiorowa, Zapobieganie stratom w przemyśle, Pol. Łódzka, Łódź 1999
[3] W. Pihowicz, Inżynieria bezpieczeństwa technicznego, Problematyka podstawowa, WNT 2009

SECONDARY LITERATURE:

[1] Granice palności zgodnie z normą PN-EN 720-2, wskaźniki wybuchowości zgodnie z normą PN-EN26184-2, temperatury zapłonu w tyglu Clevelanda i Pensky'ego Martnsa
[2] Wydawnictwo Ministerstwa Przemysłu Chemicznego pt. "Niebezpieczne materiały chemiczne - charakterystyka, zagrożenia, ratownictwo" - Biuro Wydawnicze "Chemia" Warszawa 1989r.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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