Fire University of Warsaw, Poland
Faculty of Security Engineering and Civil Protection
Syllabus 2018 -

Fire Science and Combustion

profile	general academics
degree	first degree
programme	ERASMUS
semester	1
part time / full time	full time
ECTS	4
coordinator	st. bryg. prof. dr hab. Marzena Półka

form of the activity: exercise

hours	30
prerequisites	Basic (high-school) knowledge of physics, chemical phenomena.
objectives	Basic concepts: environment fire, oxidation, combustion, fuel. Initiators of combustion, types of initiators. Laminar and turbulent combustion. Example description of laminar combustion (eg burning candles), issues related to lighting of the flame and its emissivity. Ways to initiate combustion of combustible materials – piloted ignition, ignition (autoignition), spontaneous combustion. Exposures heat produced during combustion in the fire environment. Types of combustion., mechanisms of initiation of combustion of flammable substances. The combustion of solid materials - burning plastic, wood and wood-based materials. Stability and reactivity of solid materials, their kinetic and thermodynamic properties. Thermal loads resulting from the combustion of solid materials. The smoke rate and toxicity of combustion products. The differences between homogeneous and heterogeneous combustion (oxygen) of solids. The combustion of combustible dust and their susceptibilit to ignition and explosion (burning particulate organic and inorganic).
methods	Conducting experimental research by a group of students aimed at determining the fire characteristics of selected combustible systems, including the classification of building materials under the influence of various combustion initiators in order to master the learning outcomes.

own work	Studying and analyzing available literature sources. In addition, based on experimental research conducted in the Combustion and Explosion Processes Laboratory as part of laboratory classes and calculation exercises, it is possible to verify the methods of testing the flammability of materials and products, testing the reaction to fire of building materials and interior furnishings (Euroclasses), the effectiveness of fire-protective modification of materials and the effectiveness of fixed fire extinguishing devices, determining the fire and explosive parameters of liquid/flammable gas vapors or dust with air. In parallel with the research, an analysis of the toxicity of the fire environment is carried out (including smoke generation and limitation of the range of visibility in smoke) and an environmental analysis based on life cycle analysis methods. Observations of phenomena occurring in nature and technology and attempts to model them. Attempts to select research or analytical methodologies in order to describe combustion processes and, consequently, classification of the material. Solving tasks available in the literature in order to consolidate the acquired knowledge and develop skills for quick assessment of fire phenomena. Attempts to indicate possible fire and explosion hazards in the environment and the possibility of limiting their undesirable effects.
basic literature	Eckhoff, Rolf K., Explosion hazards in the process industries, Gulf Publishing Company, 2005 Palmer, K.N., Dust Explosions and Fires: Head of Industrial and Toxic Hazards Section: Fire Research Station / K.N. Palmer, London 2003. Karlsson, Björn., Enclosure Fire dynamics, London ; New York : 2022. Babrauskas, Vytenis., Smoldering fires, Fire Science Publishers, Fire Science and Technology Inc., New York : 2021.
supplementary literature	

contents	hours
Determination of flash point of liquids.	3
Determination of ignition temperature of the liquid.	3
Determination of explosion limits of gases and vapors.	3
Determination of the heat of combustion. Research ignition temperature of plastics.	3
Study of burning behavior by oxygen index.	3
Research ignition temperature of dust cloud.	3
Research ignition temperature of dust layer.	3
Research flammability of building materials exposed to direct flame.	3
The study of flat textiles.	2
Determination of specified optical density of smoke.	2
Final exam.	2

form of the activity: exercise

hours	10
prerequisites	Knowledge of the basics of chemistry and physics, particularly the theory of heat transfer, thermodynamics, electromagnetic radiation, and kinetics of chemical reactions.

objectives	Acquiring the ability to interpret phenomena, concepts, requirements in the field of fire safety related to the combustion of gases, liquids, solids and calculations of parameters important from the point of view of fire and explosion safety. In addition, learning research methods enabling the measurement of basic flammable properties and fire characteristics of flammable liquids and gases and materials, including building materials.
methods	
own work	Studying and analyzing available literature sources. In addition, based on experimental research carried out in the Laboratory of Combustion and Explosion Processes as part of laboratory classes and calculation exercises, it is possible to verify the methods of testing the flammability of materials and products, testing the reaction to fire of building materials and interior furnishings (Euroclasses), the effectiveness of fire-resistant modification of materials and the effectiveness of fixed fire extinguishing devices, marking the fire and explosion parameters of liquid/flammable gas vapors or dust with air. In parallel with the research, an analysis of the toxicity of the fire environment (including smoke generation and limitation of the range of visibility in smoke) and an environmental analysis based on life cycle analysis methods are carried out. Observations of phenomena occurring in nature and technology and attempts to model them. Attempts to select research or analytical methodologies in order to describe combustion processes and, consequently, classification of the material. Solving tasks available in the literature in order to consolidate the acquired knowledge and develop skills for quick assessment of fire phenomena. Attempts to indicate possible fire and explosion hazards in the environment and the possibility of limiting their undesirable effects.
basic literature	Eckhoff, Rolf K., Explosion hazards in the process industries, Gulf Publishing Company, 2005 Palmer, K.N., Dust Explosions and Fires: Head of Industrial and Toxic Hazards Section: Fire Research Station / K.N. Palmer, London 2003. Karlsson, Björn., Enclosure Fire dynamics, London ; New York : 2022. Babrauskas, Vytenis., Smoldering fires, Fire Science Publishers, Fire Science and Technology Inc., New York : 2021.
supplementary literature	

contents	hours
Basic concepts: the tetrahedron combustion, fire environment, oxidation, combustion, fire, fuel. Initiators of combustion, types of initiators. Feature fire. thermal radiation	2
The combustion of combustible phase systems. The mechanisms of initiation of combustion gases, vapor.	2
The combustion of solid materials. Stability and reactivity of solid materials, their kinetic and thermodynamic properties. The differences between the combustion of solid materials.	2
Thermal loads resulting from the combustion of solid materials.	2
Combustion of dust. Elements of the theory of fires-fire environments on the environment	1
Elements of the theory of explosion - types, types of explosive hazards associated with outbreaks.	1