Module title	**Industrial Chemical Process Safety**
Code	C6
Degree Programme	Master of Science in Life Sciences
Group	Chemistry
Workload	3 ECTS (90 student working hours: 32 h contact (= 42 lessons), 58 h self-study)
Module Coordinator	**Name:** Dr. Ludovic Gremaud **Phone:** +41 26 429 68 06 **Email:** ludovic.gremaud@hefr.ch **Address:** HEIA-FR, Chemistry Department, Bd. Pérolles 80, 1700 Fribourg
Lecturers	• Dr. Ludovic Gremaud, HEIA-FR • Dr. Véronique Breguet-Mercier, HEIA-FR • Dr. Pierre Brodard, HEIA-FR • Dr. Roger Marti, HEIA-FR • Dr. Andreas Zogg, FHNW • Guest lecturers, experts from the industry
Entry requirements	Chemistry at Bachelor of science level **Knowledge requirement:** • *Physical chemistry:* thermodynamics & kinetics, thermal analysis (DSC), basic concepts of thermal safety (criticality classes) • *Industrial chemistry:* Industrial unit operation (filtration, distillation, drying…), process scale-up & safety, EHS **Way to support/encourage students to reach it:** • Preparatory reading and exercises, including a self-test for students to check their actual understanding of the topics and to give them the opportunity to have the skills and knowledge to be ready for the summer school
Learning outcomes and competences	**After completing the module, students will be able to:** • Appreciate how to give support to process development, operational excellence and manufacturing activities with DynoChem & Reaction Lab tools as well as MATLAB • Understand the role and importance of safety valves within de production industries as well as the pathway to design it • Apprehend how to develop, interpret and apply EHS concept including compilation of regulatory relevant documents • Put into practice appropriate process safety tools, master hazardous chemistry as well as assess and explain results for process review
Module contents	• Understanding of the interconnected nature of process safety and design of production unit • Evaluate the thermal safety risk of various chemical processes, based on Case Studies • Concept and approach for green process development of hazardous reactions, operational excellence and engineering activities • Role and responsibilities towards Environmental, Health & Safety legal right • Integration of specific requirements for Process R&D & Production activities in a Highly Potent API environment

<table>
<tr><td>Teaching / learning methods</td><td>

Basic concepts and theoretical background by lecturers
Inputs by guest lectures from industry and academia
Exercises and analysis of case studies coming from the industries and academia
KiloLab & Pilot Plan visits with hands demonstration and/or exercises
Questions & Answers session (individual and group support)

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<tr><td>Assessment of learning outcome</td><td>
1. Entry exam prior the summer school, individual, open book (20%)
2. Resolve case studies, individually and in group (3-4), open book (40%)
3. Bibliographic report based on a scientific publication/chapter book, submission deadline 7 days after the summer school, groups of min. 2 people, open book (40%)
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<tr><td>Format</td><td>Summer school</td></tr>
<tr><td>Timing of the module</td><td>
Spring semester, CW26
<table>
<tr><th>Day of the block week</th><th><1</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>>5</th></tr>
<tr><td>Contact teaching (lessons)</td><td></td><td>8</td><td>9</td><td>8</td><td>9</td><td>8</td><td></td></tr>
<tr><td>Self-study (hours)</td><td>24</td><td>3</td><td>2</td><td>3</td><td>2</td><td>0</td><td>24</td></tr>
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<tr><td>Venue</td><td>Mix of online and on-site lectures (in Fribourg)</td></tr>
<tr><td>Bibliography</td><td>

Ullmann’s Encyclopedia of Industrial Chemistry. DOI: 10.1002/14356007
Dynochem Resources. Locate to: https://www.scale-up.com/
Techniques de l’ingénieur. Locate to: https://www.techniques-ingenieur.fr/
Ignatowiz, E. (1997). Chemietechnik. Haan-Gruiten: Verlag Europa-Lehrmittel
Stoessel, F. (2008). Thermal Safety of Chemical Processes. Weinheim: WILEY-VCH
Legal texts regarding chemistry (chapter 813). Locate to: https://www.admin.ch/opc/fr/classified-compilation/81.html

Lectures notes (PDF) and additional material (exercises) will be delivered in addition before and during the module.
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<tr><td>Language</td><td>English</td></tr>
<tr><td>Links to other modules</td><td>
Coordination with modules:

C4, Green Chemistry
C5, Chemistry and Energy

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<tr><td>Comments</td><td>-</td></tr>
<tr><td>Last Update</td><td>13.09.2021</td></tr>
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