Module	**Process Chemistry and Development**
Code	MLS_S01
Degree Program	Master of Science in Life Sciences (MSLS)
Cluster	Chemistry
Specialization	Chemical Development and Production
ECTS Credits	4
Workload	120 student working hours: 56 lessons contact = 42 h; 78 h self-study
Module Coordinator	**Name** Dr. Roger Marti **Phone** +41 (0)26 429 67 03 **Email** roger.marti@hefr.ch **Address** Haute école d'ingénierie et d'architecture de Fribourg, Bd de Pérolles 80, CH-1700 Fribourg
Lecturers	• Dr. Christophe Allemann, HEIA-FR • Dr. Olimpia Mamula Steiner, HEIA-FR • Guest lecturers
Entry Requirements	Bachelor of Science in Chemistry or in a related course of study including organic courses (Bachelor level)
Learning Outcomes and Competences	After completing the module students will be able within the concept of Process Chemistry to: • understand and apply advanced organic chemistry and the concepts of green chemistry • realize a route finding and route selection • realize asymmetric syntheses and biocatalysis • plan and realize the enabling of synthesis on lab scale and perform a lab optimization (solvent/reagent selection, catalysis) • understand and apply novel synthesis technologies
Module Content	Process Chemistry: Synthesis Development • Knowledge of the concepts of basic process research and implication on Process Research and Development (PRD) & production • Reaction Metrics (E-Factor, etc.) and Green Chemistry • Route finding & selections - concepts, applications & case studies • Knowledge of the concepts of route enabling and synthesis optimization: "green" choice of solvent, reagent, catalysts, etc. • Knowledge of applications & the use of catalysis in PRD Process Chemistry: Chemical Development

	• Route Enabling & Lab Optimization • Planning and execution of laboratory work • Kinetics & Mechanism evaluation in PRD • Optimization by understanding impurities and structure elucidation (2D-NMR) Advanced Asymmetric Synthesis & Catalysis • Knowledge of the concepts of asymmetric synthesis & applications • Applications of biocatalysis in organic synthesis
Teaching / Learning Methods	• Lectures • Individual and group exercises • Active participation in the module is requested
Assessment of Learning Outcome	• Written exam (closed book): 100% of the final grade • Reassessment: oral exam
Bibliography	• N. G. Anderson, "Practical Process Research & Development", Academic Press Second Edition 2012. • N. Yasuda, “The Art of Process Chemistry”, Wiley 2010 • R.A. Sheldon, I. Arends, U. Hanefeld, "Green Chemistry & Catalysis", Wiley 2007. • A. Collet, J. Crassous, L. Guy : « Molécules chirales – Stéréochimie et propriétés », CNRS Editions, EDP Sciences, 2006 • N. J. Turner, L. Humphreys “Biocatalysis in Organic Synthesis – The Retrosynthesis Approach”, RSC Books 2018 • Andrew P. Dicks, Andrei Hent, “Green Chemistry Metrics, a guide to determining and evaluating process greenness”, Springer Briefs in Molecular Science, 2015 Documentation: http://cyberlearn.hes-so.ch (requires a login)
Language	English
Comments	-
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