Modulbezeichnung:	**Basics in Advanced Processes 1+2: Unit Operations and Reactor Design, Chemical Analysis and Structure Determination (Basics AP 1+2)** (Basics in Advanced Processes 1+2: Unit Operations and Reactor Design, Chemical Analysis and Structure Determination)	**5 ECTS**
Modulverantwortliche/r:	Robin N. Klupp Taylor	
Lehrende:	Liudmila Mokrushina, Marco Haumann, Alexandra Inayat, Karsten Müller, Peter Schulz, Robin N. Klupp Taylor	

Startsemester: WS 2019/2020	Dauer: 2 Semester	Turnus: halbjährlich (WS+SS)
Präsenzzeit: 30 Std.	Eigenstudium: 120 Std.	Sprache: Englisch

Lehrveranstaltungen:

Basics in Advanced Processes 1 (WS 2019/2020, Vorlesung, 2 SWS, Marco Haumann et al.)
Chemical Analysis and Structure Determination (SS 2020, Vorlesung, 2 SWS, Peter Schulz et al.)

Inhalt:

This module provides students with the fundamentals and examples of chemical processes along with an overview of analytical techniques which support modern process development and product design. Basics in Advanced Processes 1: The lecture course Basics in Advanced Processes 1 commences with an introduction to chemical processes and their principal characteristics. An overview of practical and economic aspects of chemical process design is given. With case studies, the concepts of unit operations (especially mechanical processes of mixing and separation and thermal processes of separation including distillation and gas scrubbing) are introduced. Fundamental topics in heat and mass transport and chemical conversion are then presented before their application to chemical reactor design is considered. The lecture course ends with a series of case studies covering highly relevant chemical processes including ammonia synthesis, steam cracking and fluid catalytic cracking, silicon production and hydroformylation. Chemical Analysis and Structure Determination: In the lecture course Basics in Advanced Processes 2 - Chemical Analysis and Structure Determination the following analytical techniques are presented with practical demonstrations where possible:

- liquid and gas chromatography
- inverse gas chromatography (IGC) / headspace analysis (HS-GC)
- methods of X-ray diffraction
- gas absorption/desorption and porosimetry
- thermal analysis
- mass spectrometry
- nuclear magnetic resonance (NMR) techniques incl. liquid state NMR, solid state NMR and magnetic resonance imaging (MRI)
- particle sizing techniques based on light scattering
- non-linear optical techniques for interfacial analysis

Lernziele und Kompetenzen:

Students who successfully participate in this module can:

- identify the key characteristics of chemical processes and their design considerations
- classify different unit operations used in chemical processes
- use concepts from heat and mass transport and chemical conversion along with unit operations to design elementary chemical processes
- describe the operation of several key chemical processes used in industry
- explain the fundamental operating principles of a range of analytical techniques and identify their limitations
- select appropriate analytical techniques to determine the physical or chemical characteristics of an intermediate or product of a chemical process

Literatur:

- Jess and P. Wasserscheid in Chemical Technology (2013) Wiley-VHC, Weinheim
- W. McCabe, J. Smith, P. Harriott in Unit Operations of Chemical Engineering (2005) McGraw-

Hill,Boston

Further recommended reading will be announced in the lectures.

Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:

Das Modul ist im Kontext der folgenden Studienfächer/Vertiefungsrichtungen verwendbar:

[1] **Advanced Materials and Processes (Master of Science)**
(Po-Vers. 2019w | TechFak | Advanced Materials and Processes (Master of Science) | Pflichtmodule | Advanced Processes)

Studien-/Prüfungsleistungen:

Advanced Processes 1+2: Unit Operations and Reactor Design, Chemical Analysis and Structure Determination (Prüfungsnummer: 1751)
(englische Bezeichnung: Basics in Advanced Processes 1+2: Unit Operations and Reactor Design, Chemical Analysis and Structure Determination)

Prüfungsleistung, Klausur, Dauer (in Minuten): 120
Anteil an der Berechnung der Modulnote: 100% Prüfungssprache: Englisch

Erstablegung: SS 2020, 1. Wdh.: WS 2020/2021
1. Prüfer: Robin N. Klupp Taylor

Advanced Processes 1: Unit Operations and Reactor Design (Prüfungsnummer: 1752)
Prüfungsleistung, Klausur, Dauer (in Minuten): 60
Anteil an der Berechnung der Modulnote: 50% Prüfungssprache: Englisch

Erstablegung: WS 2019/2020, 1. Wdh.: SS 2020
1. Prüfer: Marco Haumann

Advanced Processes 2: Chemical Analysis and Structure Determination (Prüfungsnummer: 1753)
Prüfungsleistung, Klausur, Dauer (in Minuten): 60
Anteil an der Berechnung der Modulnote: 50% Prüfungssprache: Englisch

Erstablegung: SS 2020, 1. Wdh.: WS 2020/2021
1. Prüfer: Robin N. Klupp Taylor
