The Hong Kong University of Science and Technology

UG Course Syllabus (short version)

Course Title: Pharmaceutical Engineering
Course Code: CENG4670
No. of Credits: 3
Pre-requisites: CHEM1010 OR CHEM1012

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Course Description

Scope

This course aims to equip students with broad knowledge in pharmaceutical engineering. The topics span from early drug discovery to late commercial manufacturing. Theory and practice of the chemical synthesis and the manufacture of active pharmaceutical ingredients (APIs), solid-state characterization of APIs, and formulation of various pharmaceutical dosage forms are covered, including controlled-release formulations and its mathematical modelling. The course also introduces students to some of the main challenges in current pharmaceutical research and development related to selected topics such as continuous manufacturing and advanced process analytical technologies.

Intended Learning Outcomes

- Explain key characteristics and mechanisms for drug action, measurement, and administration routes.
- Classify and identify different solid-state forms of APIs and explain their importance for manufacturing and product quality.
- Design and analyze pharmaceutical crystallization processes and workup steps.
- Synthesize and explain the formulation of liquid-dosage forms.
- Synthesize and explain formulations of oral solid-dosage forms and design a process sequence for tablet manufacturing.
- Develop and analyze a basic mathematical model describing the API release from solid-dosage forms.

Content

<u>Part 1: The manufacture and properties of Active Pharmaceutical Ingredients (APIs)</u>.

- Overview of pharmaceuticals and pharmaceutical industry; bioavailability; general mechanism of drug action; role of chemical engineer in pharmaceutical industry.
- Importance, discovery, and synthesis of APIs.
- Solid-state properties and industrial formation and separation of solid APIs.
- Future trends in the manufacture of APIs.

<u>Part 2: Formulation of APIs into drug products.</u>

- Overview and selection of pharmaceutical dosage forms.
- Emulsions and creams
- Tablets and capsules
- Controlled release formulations: physical principles and quantitative modelling
- Guest lecture(s)

Assessments:

Assessment Task	Contribution to Overall Course grade (%)
Homework sets	25%
In-class tutorials	5%
Mid-term quiz	20%
Final examination	50%

Main texts

- Aulton ME & Taylor KMG. (2018) Aulton's Pharmaceutics, 5th Edition -- The Design and Manufacture of Medicines. Churchill Livingstone, London, U.K.
- Blacker AJ & Williams MT. (2011) Pharmaceutical Process Development: Current Chemical and Engineering Challenges edited by A. John Blacker and Michael T. Williams. Royal Society of Chemistry, Cambridge, U.K.
- Various academic papers will be distributed through Canvas.

Background reading:

- Am Ende, DJ (2011) Chemical engineering in the pharmaceutical industry: R&D to manufacturing. Hoboken, New Jersey, Wiley, 2011.