CHEN90035 Advanced Topics in Chemical Engineering

Credit Points: 12.5

Level: 9 (Graduate/Postgraduate)

Dates & Locations: This subject is not offered in 2016.

Time Commitment: Contact Hours: Three modules where students must complete two: (1) Chemical Product Development: 9 X 3 hour lectures, 1 X 3 hour workshop. (2) Minerals and Materials: 9 X 3 hour lectures, 1 X 3 hour workshop. (3) Chemical Engineering Laboratory and Design: 3 X 3 hour laboratory classes, 10 X 1 hour consultation/design sessions, 1 X 3 hour workshop. Total Time Commitment: 200 hours

Prerequisites:

Subject	Study Period Commencement:	Credit Points:
CHEN30001 Reactor Engineering	Semester 1	12.50

Prior to 2010 CHEN40003 Reactor Engineering

Subject	Study Period Commencement:	Credit Points:
CHEN30005 Heat and Mass Transport Processes	Semester 1	12.50

AND:

Subject	Study Period Commencement:	Credit Points:
ENGR30002 Fluid Mechanics	Semester 1, Semester 2	12.50

Prior to 2013 ENGR30001 Fluid Mechanics & Thermodynamics

Corequisites: None

Recommended Background Knowledge: None

Non Allowed Subjects: None

Core Participation Requirements: <p>For the purposes of considering request for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005), and Student Support and Engagement Policy, academic requirements for this subject are articulated in the Subject Overview, Learning Outcomes, Assessment and Generic Skills sections of this entry.</p> <p>It is University policy to take all reasonable steps to minimise the impact of disability upon academic study, and reasonable adjustments will be made to enhance a student's participation in the University's programs. Students who feel their disability may impact on meeting the requirements of this subject are encouraged to discuss this matter with a Faculty Student Adviser and Student Equity and Disability Support: http://services.unimelb.edu.au/disability</p>

Contact:

Prof Ray Dagastine

Email: **rrd@unimelb.edu.au (mailto:rrd@unimelb.edu.au)**

Subject Overview:

This subject is modular in nature where students must complete two of the three modules, Chemical Product Development (1), Minerals and Materials (2) and Chemical Engineering Laboratory and Design (3). The subject will be undertaken concurrently with students from the University of Delaware through a Study Abroad program.

AIMS

Chemical Product Development (1)

Internationally, approximately fifty precent of chemical engineers are employed in positions related to chemical product development and design. The aim of this module is to introduce students to the concepts behind chemical product design. This includes an introduction to the chemical product design method as well as the concept of management or decision gates in the process. This will include both educational and real world examples of how chemical product development takes advantage of fundamental aspects of chemical engineering including transport diffusion, chemical kinetics, interfacial phenomena and microstructure and flow.

Minerals and Materials (2)
The importance of the minerals industry to the Australian economy. Liberation, size reduction, size separation and concentration separations in minerals processing. Extractive metallurgy, including hydrometallurgy and pyrometallurgy. Aspects of physico-chemical principles of mineral separation processes to produce metals and ceramic products from ores as well as recycled materials and consumer products. The influence of interatomic bonding and material atomic structure on material behaviour. Phase diagrams and equilibria as well as material mechanical, electrical and magnetic properties will be covered. The process of developing material selection criteria and selecting materials for particular applications will be presented.

Chemical Engineering Laboratory and Design (3)
Senior design project integrates practical experimental work with major equipment design. Students design a laboratory protocol in consultation with a supervisor. The students then execute their protocol to determine basic physical properties of a system (such as equilibrium information), which is then used to design a more advanced equipment item. There are 3 distinct projects. There is an enrolment quota on this module.

INDICATIVE CONTENT

Chemical Product Development (1)
Chemical product design approach and the four key aspects, different class of chemical products. Estimation of chemical product design specifications based on diffusion, reaction and transport phenomena. The role of surfaces in processing and materials manufacture. How to use a basic knowledge of interfacial phenomena to control the microstructure of a chemical product. At an introductory level, how inter-particle forces affect coagulation, dispersion and stability criterion as well as parameters that influence flow and gelation properties. The role of molecular additives in controlling dispersion and emulsion and stability in an applied framework, such as using HLB index..

Minerals and Materials (2)
Understand: mineral processing separation concepts; processing-structure-property relationships; atomic bonding and atomic scale structure in materials; thermodynamic basis for phase equilibria; influence of material properties on recyclability; influence of recycling on material purity and properties.

Know how to design mineral separation processes; use phase diagrams; derive a number of material properties based upon atomic bonding and atomic scale structure.

Be familiar with: similarities and differences in mineral processing and recycling; equipment used in size reduction and separation and concentration separations; extractive metallurgy; typical minerals processing and metals production processes; typical properties of metals, polymers, ceramics and semiconductors; influence of materials on society; influence of microstructure on material properties; mechanical, electrical, magnetic, optical and thermal properties of materials; typical material processing; be able to select materials for particular applications.

Chemical Engineering Laboratory and Design (3)
The basis of this course is three laboratory experiments using pilot plant scale equipment. Experiments include the start-up, operation and shut down of a distillation column to separate a binary mixture of chemicals, the absorption of carbon dioxide (for possible sequestration) from a gas stream, climbing film evaporation.

Learning Outcomes:

INTENDED LEARNING OUTCOMES (ILO)

On completion of this subject the student is expected to;

Chemical Product Development:

1. Understand the chemical product design approach and the four key aspects of this process as well as the different classes of chemical products
2. The students will understand the relationships between fundamental chemical engineering concepts in diffusion, chemical reaction kinetics, interfacial phenomena and microstructure with chemical products properties and design criteria.
3. The students will be able to connect this knowledge to real world examples of chemical products.

	Minerals and Materials: 4. Understand the complex interaction of processes within the material cycle i.e. starting with primary material production from minerals, material production and properties, consumer products. This will be based on material science principles, thermodynamics, system engineering and optimization 5. The students will understand the relationships between materials composition, processing, microstructure and properties.The students will be able to select materials for particular engineering design applications 6. Chemical Engineering Laboratory and Design 7. Understand the fundamental chemical engineering concepts behind running distillation and absorption unit operations as well as practical issues around running these processes. 8. The students will be able to use data from laboratory scales measurements to solve larger scale design problems 9. The students will be able to develop this skills in trade offs and engineering judgement in the design of chemical engineering process equipment.
Assessment:	Chemical Product Development (1): Note: 100% corresponds to this module. Continuous assessment comprising regular assignments (30%). Approximately 15 hours of work in total. Due Week 4 A written report (2000 word) on the design of commercial chemical product (30%). Approximately 15 hours of work in total. Due week 2 One 1-hour mid-semester examination (15%). Held in Week 4 One 1-hour end-of-semester examination (15%) An oral presentation (15 min.) on the design of a commercial chemical product (10%) Approximately 7 hours of work in total. Assessed in week 4. Intended Learning Outcomes (ILOs) 1 - 3 are addressed in the examination and the regular assignments Students must achieve 50% of the available assessment in this module to pass the subject Minerals and Materials (2): Note: 100% corresponds to the module. Continuous assessment comprising regular assignments (30%). Approximately 15 hours of work in total. Assessed between weeks 1 to 4. One written 3-hour end-of-semester examination (70%). Intended Learning Outcomes (ILOs) 4 - 6 are addressed in the examination and the regular assignments. Students must achieve 50% of the available assessment in this module to pass the subject Chemical Engineering Laboratory and Design (3): Note: 100% corresponds to the module.For each laboratory, where students do 3 laboratories: A written pre-laboratory report (2000 word). Approximately 30 hours of work in total. (15% total; 5% each) A written a post-laboratory report (2000 word). Approximately 75 hours of work in total. (37.5% total; 12.5% each) A written equipment design specification (1000 word). Approximately 75 hours of work in total. (37.5% total; 12.5%) An oral presentation (15 min.) on the design specification of the final laboratory (10%). Approximately 20 hours of work in total. Intended Learning Outcomes (ILOs) 7 - 9 are addressed in the examination and the regular assignments Students must achieve 50% of the available assessment in this module to pass the subject Total Assessment: Students must take two (A&B) out of the three modules.Module A (1, 2, or 3) – 50%Module B (1, 2, or 3) – 50%
Prescribed Texts:	None
Breadth Options:	This subject is not available as a breadth subject.
Fees Information:	Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees
Generic Skills:	# Capacity for independent thought # Awareness of advanced technologies in the discipline # Ability to apply knowledge of basic science and engineering fundamentals # Ability to undertake problem identification, formulation and solution # Ability to utilise a systems approach to design and operational performance
Related Course(s):	Doctor of Philosophy - Engineering Master of Philosophy - Engineering
Related Majors/Minors/ Specialisations:	Master of Engineering (Biochemical) Master of Engineering (Chemical)