CHEN90009 Fermentation Processes

Credit Points:	12.50
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	This subject is not offered in 2014.
Time Commitment:	Contact Hours: 3 x one hour lectures + 1 x one hour tutorial per week + 2 x four hours of laboratory work per semester Total Time Commitment: Estimated 200 hours
Prerequisites:	Students must have completed the following subject prior to enrolling in this subject: **Subject** / **Study Period Commencement:** / **Credit Points:** CHEN30001 Reactor Engineering / Semester 1 / 12.50 AND students must have completed the following subject (or equivalent) prior to enrolling in this subject: **Subject** / **Study Period Commencement:** / **Credit Points:** CHEN90016 Metabolic Engineering / Not offered 2014 / 12.50
Corequisites:	None
Recommended Background Knowledge:	None
Non Allowed Subjects:	None
Core Participation Requirements:	For the purposes of considering applications for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005) and Students Experiencing Academic Disadvantage Policy, this subject requires all students to actively and safely participate in laboratory activities. Students who feel their disability may impact upon their participation are encouraged to discuss this with the Subject Co-ordinator and the Disability Liaison Unit http://www.services.unimelb.edu.au/disability/
Contact:	Email: **gjmartin@unimelb.edu.au (mailto:gjmartin@unimelb.edu.au)**
Subject Overview:	**AIMS** This is the last of the three specialised subjects in the Biomolecular engineering course. The subject integrates basic chemical engineering skills with the knowledge of cell biology and metabolic engineering gained in previous subjects to develop an understanding of how to implement, engineer and design systems for large-scale production using cell cultures. This includes development of mathematical expressions of cell culture kinetics based on an understanding of the inner workings of cells, and the design of fermentation and product recovery systems using knowledge of mass transfer, reactor design, and mass flow analysis. Students will be introduced to using computational methods to describe and optimise fermentation processes. The subject will include exercises in process optimisation and the solution of ill-defined process problems. The cell culture kinetic models, fermentation process equipment, and upstream and downstream unit operations covered in this subject are universal to professional chemical engineers working in fermentation and bioprocessing industries. **INDICATIVE CONTENT** Topics covered include: principles of microbial growth; stoichiometry and growth models; development of batch, fed-batch and continuous culture kinetic models; product formation; sterilisation and aseptic equipment design; factors affecting the selection of media for industrial fermentations; fermenter design including oxygen transfer and mixing, materials selection, process monitoring and control, and scale-up. Downstream processing is also covered including

	cell disruption, application of solid-liquid separation technologies, and product recovery processes such as ion exchange and chromatography. The subject also addresses special requirements of plant and animal cell culture, large-scale cultivation of microalgae, ethical, legal and regulatory issues in fermentation process engineering, and includes a number of case studies including processes for the production of specific products such as biofuels. Practical laboratory sessions exploring batch fermentation kinetics and downstream separation techniques will be included.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILOs)** On completion of this subject the student is expected to: 1 Develop mathematical expressions to describe fermentation processes 2 Perform the basic design of industrial scale fermentation processes 3 Understand the principles of product recovery and purification from fermentation processes 4 Solve open-ended design and optimisation problems in fermentation process engineering 5 Exhibit practical skills in the conduct of fermentations and associated downstream separation processes
Assessment:	Two problem based assignments, spaced apart in the middle of the semester, each of no more than 1000 words (5% each). Two practical work reports, spaced apart in the middle of the semester, each no more than 2000 words (10% each) associated with the laboratory experiments. One written three hour end-of-semester examination (70%). Hurdle requirement: A mark of 40% or more in the end of semester examination is required to pass the subject. Intended Learning Outcomes (ILOs) 1 to 4 are addressed in the examination and the two problem based assignments. ILO 5 is addressed in the two practical work reports. The examination paper will consist of problems designed to test whether the student has acquired the ability to apply fundamental principles to the solution of problems involving fermentation processes.
Prescribed Texts:	None
Recommended 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:	# In-depth technical competence in at least one engineering discipline # Ability to utilise a systems approach to design and operational performance # Ability to apply knowledge of basic science and engineering fundamentals
Notes:	**LEARNING AND TEACHING METHODS** The subject will be delivered through a combination of lectures and tutorials. Tutorials include a combination of manual problem-based tutorials as well as interactive open-ended computer-based tutorial sessions. Students will also complete two laboratory experiments. **INDICATIVE KEY LEARNING RESOURCES** Students will have access to lecture notes and lecture slides. The subject LMS site also contains numerical solutions for practice problems and supplementary learning material including example spreadsheets and scientific papers. **CAREERS / INDUSTRY LINKS** The skills gained in this subject are crucial to the career of a bioprocess engineer. They will be important for students wishing to progress to jobs in engineering design offices and in operational roles within a range of industries inclusing food processing, pharmaceutical manufacture, wastewater treatment and fermentation industries.
Related Majors/Minors/ Specialisations:	B-ENG Chemical and Biomolecular Engineering stream Master of Engineering (Biochemical)