CHEN20010 Material and Energy Balances

Credit Points: 12.5

Level: 2 (Undergraduate)

Dates & Locations:

2016, Parkville

This subject commences in the following study period/s:
Semester 1, Parkville - Taught on campus.
Semester 2, Parkville - Taught on campus.

Time Commitment: Contact Hours: 36 x one hour lectures, 11 x two hour tutorials/workshops and 2 x three hour laboratory classes Total Time Commitment: 170 hours

Prerequisites:

Subject	Study Period Commencement:	Credit Points:
ENGR10004 Engineering Systems Design 1	Semester 1, Semester 2	12.50

AND ONE OF:

Subject	Study Period Commencement:	Credit Points:
MAST10009 Accelerated Mathematics 2	Semester 2	12.50
MAST10006 Calculus 2	Semester 1, Semester 2	12.50

AND ONE OF:

Subject	Study Period Commencement:	Credit Points:
CHEM10003 Chemistry 1	Semester 1, Semester 2	12.50
CHEM10006 Chemistry for Biomedicine	Semester 1	12.50

OR

Be enrolled in one of the following courses:

MC-ENG Master of Engineering (Biochemical)
MC-ENG Master of Engineering (Chemical)
MC-ENG Master of Engineering (Chemical with Business)

Corequisites: None

Recommended Background Knowledge: None

Non Allowed Subjects:

Subject	Study Period Commencement:	Credit Points:
CHEN20007 Chemical Process Analysis 1	Semester 2	12.50
CHEN20008 Chemical Process Analysis 2	Semester 2	12.50

Core Participation Requirements: 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. 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>
Coordinator:	Prof David Shallcross
Contact:	Prof David Shallcross **dcshal@unimelb.edu.au (mailto:dcshal@unimelb.edu.au)**
Subject Overview:	**AIMS** This subject introduces chemical engineering flow sheet calculations, including material balances, energy balances and compositions of mixtures. The concept of conversion of mass is developed as the basis for determining mass flows in chemical processing systems involving chemical reactions and separation systems. Then the concept of conservation of energy is developed as the basis for determining energy flows in and around chemical processing systems, evaluation of enthalpy changes with and without phase change, simplified energy balances for batch, steady-state and adiabatic systems, estimation of heats of reaction, combustion, solution and dilution, energy balances in reacting systems, simultaneous material and energy balances. This subject provides the basis for all the chemical engineering subjects that follow. The calculations introduced in this subject are the most common type of calculations performed by professional chemical engineers working in all sectors of industry. The teaching of process safety is critical to any undergraduate chemical engineering program. Students need to understand their responsibilities to themselves, their work colleagues and the wider community. They need to be aware of safe practices and also the consequences that may arise when those safe practices are not followed. This subject introduces students to concepts of process safety and the consequences when safety management systems fail. **INDICATIVE CONTENT** Topics covered include material balances around single process units and groups of units, involving simple systems and recycle streams, and non-reacting and reacting systems. Total, component, and elemental balances are covered. Other topics include systems of units and unit conversion, and compositions of mixtures. Energy balances: The concepts of energy, work and heat, the units of energy, internal energy, enthalpy, heat capacity, latent heat, evaluation of enthalpy changes. The general energy balance equation, enthalpy balances, system boundaries. Enthalpies of pure components and selection of enthalpy data conditions. Energy balances and chemical reactions: Heat of reaction, definitions of standard heat of reaction, standard heat of formation, standard heat of combustion. Hess' Law of adding stoichiometric equations. Adiabatic reaction temperature. Heats of solutions and dilution, and use of enthalpy-concentration charts. Simultaneous material and energy balances. Safety case studies, safe practices, personal and process safety.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILOs)** On completion of this subject the student is expected to: 1 Apply knowledge of basic science and engineering fundamentals to solve material and energy balances 2 Be able to model material and energy flows around reacting chemical systems 3 Define and scope engineering problems and formulate suitable strategies for problem solution 4 Have developed an appreciation for the importance of safety in the process industries.
Assessment:	One team based presentation with 3 to 4 team members of approximately 15 to 20 minutes, requiring 8 to 10 hours of work (10%). Intended Learning Outcomes (ILOs) 1, 3 and 4 are addressed in this activity. Assessed weeks 5 to 7 Attendance and participation in two laboratory classes each with a written assignment of approximately 1000 words each requiring 10 to 12 hours of work including preparation (20% - 10% each). ILO's 1 to 4 are addressed in these activities. Assessed weeks 6 to 11 One written 3-hours closed book examination (70%). ILO's 1

	to 4 are addressed in the exam. The examination must be passed to pass the subject. Held end of semester examination period.
Prescribed Texts:	Shallcross D.C., “Physical Property Data Book for Engineers and Scientists”, IChemE, London, 2004
Breadth Options:	This subject potentially can be taken as a breadth subject component for the following courses: # **Bachelor of Arts (https://handbook.unimelb.edu.au/view/2016/B-ARTS)** # **Bachelor of Commerce (https://handbook.unimelb.edu.au/view/2016/B-COM)** # **Bachelor of Environments (https://handbook.unimelb.edu.au/view/2016/B-ENVS)** # **Bachelor of Music (https://handbook.unimelb.edu.au/view/2016/B-MUS)** You should visit **learn more about breadth subjects (http://breadth.unimelb.edu.au/breadth/info/index.html)** and read the breadth requirements for your degree, and should discuss your choice with your student adviser, before deciding on your subjects.
Fees Information:	Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees
Generic Skills:	# 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 Majors/Minors/ Specialisations:	Master of Engineering (Biochemical) Master of Engineering (Chemical with Business) Master of Engineering (Chemical) Science-credited subjects - new generation B-SCI and B-ENG.
Related Breadth Track(s):	Chemical Engineering