CHEN20009 Transport Processes

Credit Points:	12.5
Level:	2 (Undergraduate)
Dates & Locations:	2016, Parkville This subject commences in the following study period/s: Semester 2, Parkville - Taught on campus.
Time Commitment:	Contact Hours: 3 x 1 hour lectures + 1 x 1 hour tutorial per week + 2 x 90 minutes of laboratory work per semester Total Time Commitment: Estimated 170 hours
Prerequisites:	**Undergraduate students:** Students must have completed ONE OF the following subjects prior to enrolling in this subject:

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

AND ONE OF:

Subject	Study Period Commencement:	Credit Points:
MAST10007 Linear Algebra	Summer Term, Semester 1, Semester 2	12.50
MAST10008 Accelerated Mathematics 1	Semester 1	12.50

AND

Subject	Study Period Commencement:	Credit Points:
CHEN20010 Material and Energy Balances	Semester 1, Semester 2	12.50

CHEN20010 Material and Energy Balances may be taken concurrently.

OR

Postgraduate students:

Admission to the MC-ENG Master of Engineering (Chemical), (Chemical with Business) or (Biochemical)

Corequisites:	None
Recommended Background Knowledge:	None
Non Allowed Subjects:	

Subject	Study Period Commencement:	Credit Points:
BMEN30007 Biotransport Processes	Semester 2	12.50

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
Coordinator:	Dr Dalton Harvie
Contact:	Dr Dalton Harvie Email: **daltonh@unimelb.edu.au (mailto:daltonh@unimelb.edu.au)**
Subject Overview:	**AIMS** This subject covers fundamental concepts of diffusion and conservation within momentum, heat and mass transport. Use of these concepts is integral to the profession of Chemical Engineering. For example, heat exchangers are used throughout Chemical Engineering processes to transfer thermal energy from one stream to another. Knowledge of heat transport and momentum transport (ie fluid flow) is required to design a heat exchanger, other key pieces of Chemical Engineering process equipment, including distillation columns. Similarly, knowledge of mass transport is required to design other key Chemical Engineering processes, such as distillation. **INDICATIVE CONTENT** The specific technical material covered in the course is as follows: Within momentum transport specific topics include Newton's law of viscosity, viscosity of gases and liquids, conservation of momentum, velocity distributions in simple laminar flows, boundary layer concepts and turbulence and the Reynolds number. Within heat transport specific topics include Fourier's law of conduction, thermal conductivities of gases, liquids and solids, conservation of thermal energy, steady-state temperature distributions in simple geometries, heat transfer resistance, thermal boundary layer concepts, the Nusselt and Prandtl numbers, definition and use of heat transfer coefficients and analysis of simple heat exchangers. Within mass transport specific topics include Fick's first law of diffusion, diffusivities of gases, liquids and solids, binary mixture diffusion and conservation of mass, concentration distributions in simple binary systems including identifying appropriate boundary conditions, concentration boundary layer concepts, Schmidt and Sherwood numbers, definition and use of mass transfer coefficients.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO)** On completion of this subject the student is expected to be able to: 1 Describe the fundamental concepts of momentum, heat and mass transfer 2 Apply these principles to the solution of problems in process engineering 3 Continue study in the area of heat and mass transport with a solid foundation.
Assessment:	One 90 minute mid-semester test (15%). All Intended Learning Outcomes (ILOs) are addressed in the test. Held around week 6 of semester Two lab-based assignments (10% total - 5% each); each consisting of no more than 250 words each (not including equations, graphs and diagrams). Overall time commitment of approximately 20-25 hours (10-13 hours per assignment). All ILOs are addressed in the assignments. One assignment due in the first-half of semester and the other in the second half of semester Five minor assessable questions (5% total - 1% each); each consisting of no more than 50 words each (not including equations, graphs and diagrams). Spread throughout the semester, starting from week 2 Three hour exam (70%); held in examination period. All ILOs are addressed in the exam.
Prescribed Texts:	None
Recommended Texts:	Bird, R.B., Stewart, W.E., and Lightfoot, E.N., *Transport Phenomena*, second edition, Wiley, 2002 and onwards Coulson, J.M., and Richardson, J.F., *Chemical Engineering Volume 1*, sixth edition, Butterworth-Heinemann, 1999
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:	None
Notes:	**LEARNING AND TEACHING METHODS** Lectures are the main mode of technical content delivery for this course. These lectures are supplemented by consultation sessions, in which students work in groups on selected tutorial problems. Practical application of the theory is via two laboratories. Two laboratory experiments will be performed during the semester: in the first, somewhere in weeks 3–6, you will do an experiment called 'Viscosity'; in the second, somewhere in weeks 8–11, you will do an experiment called 'Diffusivity'. Each experiment will be conducted in groups of 3, and will take 1.5hrs. Students are expected to spend 2-3 hours per hour of lecture time individually working through set problems. **INDICATIVE KEY LEARNING RESOURCES** Comprehensive lecture notes are made available prior to the semester commencing (free to download). All lecture slides, handouts and some multimedia material will be made available during the semester through the Learning Management System (LMS). Two books are recommended for in-depth study, but not required to purchase (both of these books are available from the library): 1 Coulson, J.M., and Richardson, J.F., Chemical Engineering, Volume 1, sixth edition, Butterworth-Heinemann, 1999 2 Bird, R.B., Stewart, W.E., and Lightfoot, E.N., Transport Phenomena, second edition, Wiley, 2002-7 (preferred). **CAREERS / INDUSTRY LINKS** This subject introduces fundamental technical concepts and does not have any industrial links. It enables further study of the subject of Chemical Engineering, leading to the analysis of industrially relevant, practical problems.
Related Majors/Minors/ Specialisations:	B-ENG Chemical Engineering stream B-ENG Chemical and Biomolecular Engineering stream Master of Engineering (Biochemical) Master of Engineering (Chemical with Business) Master of Engineering (Chemical) Science-credited subjects - new generation B-SCI and B-ENG. Selective subjects for B-BMED
Related Breadth Track(s):	Chemical Engineering