BMEN90027 Biosystems Modelling

Credit Points:	12.5
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	2016, Parkville This subject commences in the following study period/s: Semester 1, Parkville - Taught on campus.
Time Commitment:	Contact Hours: 48 hours: 3 hours of lectures per week and six 2-hour workshops / tutorials over the semester. Total Time Commitment: 200 hours
Prerequisites:	Either **Subject** / **Study Period Commencement:** / **Credit Points:** MAST20029 Engineering Mathematics — Summer Term, Semester 1, Semester 2 — 12.50 OR Both of the following subjects **Subject** / **Study Period Commencement:** / **Credit Points:** MAST20009 Vector Calculus — Semester 1, Semester 2 — 12.50 MAST20030 Differential Equations — Semester 2 — 12.50 OR Equivalent Mathematics subject
Corequisites:	None
Recommended Background Knowledge:	None
Non Allowed Subjects:	None
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
Coordinator:	Prof Edmund Crampin
Contact:	Prof Edmund Crampin Email: **edmund.crampin@unimelb.edu.au (mailto:edmund.crampin@unimelb.edu.au)**
Subject Overview:	**AIMS:** This subject introduces mathematical and computational modelling, simulation and analysis of biological systems. The emphasis is on developing models, with examples, using MATLAB. **INDICATIVE CONTENT:** Topics include:

	Modelling in Molecular and Cell Biology: Biochemical reactions. Law of mass action. Enzymes and regulation of enzyme reactions. Cell signalling and regulation of gene expression. Cellular homeostasis, volume regulation. Molecular and cellular theories of muscle. Application of ordinary and partial differential equations to these problems. Systems Biology: Modelling large reaction networks. Flux balance analysis and constraint-based methods. Genome-scale models. Thermodynamics of reversible biochemical reactions. Gene regulatory networks in systems and synthetic biology. Network inference including statistical models. Knowledge-based modelling in systems biology.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO's)** Having completed this unit the student should be able to: 1 Describe the role for mathematical and computational modelling of biological systems 2 Use the law of mass action to develop ODE models for biochemical reactions 3 Develop and analyse models for enzyme catalysed reactions in cellular bioengineering and synthetic biology 4 Develop and analyse ODE and PDE models in molecular and cellular physiology 5 Describe the premise of systems biology 6 Develop and analyse large-scale network models for biosystems and synthetic biology 7 Describe the role of knowledge-based modelling in systems biology 8 Describe the measurement technologies and sources of data underlying systems biology, data repositories and modelling approaches.
Assessment:	Participation in up to six workshops in Weeks 2 to 12, of which 4 are assessed with a written assignment of approximately 500 words, requiring 13-15 hours of work including preparation (10% each) One mid-semester test of 1 hour duration in Week 7 One written 2-hour end-of-semester examination (50%). Hurdle requirement: The examination must be passed to successfully complete the subject. Intended Learning Outcomes (ILO's) 1 to 8 are assessed in the final written examination, assignments and workshop reports. ILO's 1 to 4 are also assessed in the mid-semester test.
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:	On completion of this subject students should have developed the following generic skills: # Ability to apply knowledge of science and engineering fundamentals # Ability to communicate effectively, with the engineering team and with the community at large # Capacity for lifelong learning and professional development # Profound respect for truth and intellectual integrity, and for the ethics of scholarship.
Related Majors/Minors/ Specialisations:	Master of Engineering (Biomedical)