BMEN20001 Biomechanical Physics & Computation

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.
Time Commitment:	Contact Hours: 3 x 1 hour lectures per week, 11 x 2 hour workshops and 1 x 2 hour laboratory workshop Total Time Commitment: 170 hours
Prerequisites:	**One of** **AND one of** **OR** Admission into the MC-ENG (Biomedical) or (Biomedical with Business)
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:	Dr Vijay Rajagopal
Contact:	Vijay Rajagopal Email: **vijay.rajagopal@unimelb.edu.au (https://mce_host/faces/htdocs/%20vijay.rajagopal@unimelb.edu.au)**
Subject Overview:	**AIMS:** This subject aims to introduce students to the use of computational modelling to apply biomechanical physics to problems in bioengineering research and industry. The course introduces students to important fundamentals of software programming (through the use

One of

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

	of MATLAB) and numerical techniques to solving biomechanics equations. The course will introduce students to relevant applications in human movement, soft-tissue mechanics and cellular mechanobiology. **INDICATIVE CONTENT:** **Topics include:** # Kinematics – displacement/velocity/acceleration relationships; speed vs velocity; linear and angular velocity # Forces, moments, free body diagrams, normal/shear stress and strain # Mechanics of materials – stress/strain relations, Young's modulus, Poisson's ratio # Newton's laws # Deriving ODEs to solve simple dynamics problems – mass and spring; pendulum swing; projectile motion. # Data structures/types in programs – variables, numbers, characters, arrays, strings, floating point, single and double precision (pointers) # Writing programs – main program, functions, scope of variables in programs (whole-program vs function-specific variables) # Control structures – if/else, for loops, while loops, do until loops # Numerical methods for solving linear ODEs # Approximation and errors in numerical computation.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO's)** On completion of this subject students should be able to: 1 Use Newton's Laws of Motion to analyse equilibrium and dynamics in biomechanics applications 2 Analyse stresses and strains of biological materials under different loads 3 Analyse human motion and impact using fundamental kinematics and kinetics equations 4 Read, write and debug small-scale numerical programs in MATLAB 5 Translate biomechanics related mathemtical equations into computer programs in MATLAB 6 Implement and utilise fundamental numerical methods to solve biomechanic equations (e.g. ordinary differential equations)
Assessment:	Participation in up to 11 workshops and 1 laboratory session in Weeks 1 to 12, with 5 fortnightly written and coding assignments (the first two require 10-12 hours of work each and are worth 5% each, the final three require 20-24 hours of work each and are worth 10% each. ILO's 1-6 are assessed through the laboratory assignments One mid-semester test of 1 hour duration in weeks 5-7, 10%. ILO's 1,2,4 and 6 are assessed in the mid-semester test. One end of semester examination of three hours 50%. ILO's 1, 2, 3, 5, and 6 are assessed in the final written examination. Hurdle requirement: Students must pass the written end-of-semester examination to pass the subject.
Prescribed Texts:	None
Recommended Texts:	Humphrey JD, and Delange SL, An Introduction to Biomechanics Nihat O. Nordin M, Goldsheyder D, and Leger D, Fundamentals of Biomechanics, 3rd Edition Meriam Jl and Kraige LG, Enginerring Mechanics: Dynamics, 7th Edition Hibbeler RC, Statics and Mechanics of Materials, 3rd Edition
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:	On completion of this subject, students should have developed the following generic skills: # The ability to undertake problem identification, formulation and solution # Capacity for independent critical thought, rational inquiry and self-directed learning # Profound respect for truth and intellectual integrity, and for the ethics of scholarship # An ability to apply knowledge of basic science and engineering fundamentals
Related Majors/Minors/ Specialisations:	Master of Engineering (Biomedical with Business) Master of Engineering (Biomedical) Science-credited subjects - new generation B-SCI and B-ENG. Selective subjects for B-BMED