BMEN20001 Biomechanical Physics & Computation

Credit Points:	12.5
Level:	2 (Undergraduate)
Dates & Locations:	2015, 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 and 1 x 2 hour workshop per week Total Time Commitment: 170 hours
Prerequisites:	**One of** MAST10006 Calculus 2 — Semester 1, Semester 2 — 12.50 MAST10009 Accelerated Mathematics 2 — Semester 2 — 12.50 **AND one of** MAST10007 Linear Algebra — Summer Term, Semester 1, Semester 2 — 12.50 MAST10008 Accelerated Mathematics 1 — Semester 1 — 12.50 **OR** Admission into the MC-ENG (Biomedical), (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:	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 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:** # 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 (ILOs)** On completion of this subject students should be able to: 1 Develop and solve equations of motion for human movement 2 Employ stress/strain relations to solve problems in biological materials 3 Translate biomechanics related mathematical equations into computer programs in MATLAB 4 Read, write and debug small-scale numerical programs in MATLAB 5 Solve ordinary differential equations (ODEs) related to mechanics and critically compare different ODE solving methods against analytic solutions to choose appropriate route. 6 Solve problems in collisions mechanics using Newton's laws
Assessment:	Attendance and participation in up to 12 workshops in Weeks 1 to 12, of which 10 will be assessed each with a written and coding assignment requiring 5-6 hours of work each including preparation, 5% each; One written 1-hour mid-semester test in weeks 5-7, 10%; One written 2-hour at the end of semester 40%. Hurdle requirement: Students must pass the written exam to pass the subject. Intended Learning Outcomes (ILOs) 1, 2, 5, and 6 are assessed in the final written examination. ILOs 1-6 are assessed through the laboratory assignments and submitted reports. ILOs 1,2,4 are assessed in the mid-semester test.
Prescribed Texts:	None
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/2015/B-ARTS)** # **Bachelor of Commerce (https://handbook.unimelb.edu.au/view/2015/B-COM)** # **Bachelor of Environments (https://handbook.unimelb.edu.au/view/2015/B-ENVS)** # **Bachelor of Music (https://handbook.unimelb.edu.au/view/2015/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 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)

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