640-234 Further Classical & Quantum Mechanics

Credit Points:	12.500
Level:	Undergraduate
Dates & Locations:	2008, This subject commences in the following study period/s: Semester 2, - Taught on campus.
Time Commitment:	Contact Hours: 36 lectures and 12 1-hour tutorials Total Time Commitment: 120 hours.
Prerequisites:	Physics 640-223 or 640-243.
Corequisites:	Mathematics 620-231 or 620-233.
Recommended Background Knowledge:	None
Non Allowed Subjects:	None
Core Participation Requirements:	It is University policy to take all reasonable steps to minimise the impact of disability upon academic study and reasonable steps will be made to enhance a student's participation in the University's programs. Students who feel their disability may impact upon their active and safe participation in a subject are encouraged to discuss this with the relevant subject coordinator and the Disability Liaison Unit.
Coordinator:	Prof D Jamieson; Dr A Martin
Subject Overview:	This subject is in two parts. Half of the subject deals with the powerful and elegant Lagrangian and Hamiltonian formulations of classical mechanics. As well as supplying new tools for problems in classical mechanics, these approaches also lead to deeper insights into the relationship between classical and quantum mechanics. Lagrangian dynamics is a valuable precursor to honours-level studies in theoretical physics. The other half of the subject deals with the further development of quantum mechanics, especially in relation to three-dimensional problems and the structure of matter. Students completing this subject will be able to: # explain the basic principles of the Lagrangian and Hamiltonian formulations of classical mechanics as well as the present-day microscopic picture of matter in terms of its basic constituents, ranging from atoms, molecules and solids to atomic nuclei and their constituent particles; # apply Lagrangian and Hamiltonian techniques to the solution of some key problems in classical physics; and # solve problems in quantum mechanics relevant to the hydrogen atom and other three-dimensional problems. In addition students will enhance their ability to: # participate effectively as part of a group in tutorials; and # plan effective work schedules and manage their time to meet the deadlines for submission of assessable work and prepare for tests and examinations. Topics include review of Newtonian mechanics; Lagrangian formulation: constraints, generalised coordinates and Lagrange's equations; Hamilton's variational principle; Hamiltonian formulation: conjugate momenta, Hamilton's equations, phase space and Poisson brackets; the Hamiltonian in quantum theory; spherical harmonics and angular momentum, and the hydrogen atom; introduction to many-electron atoms, Pauli Principle and intrinsic spin; and quantum statistical physics.
Assessment:	Tests totalling up to 2 hours and assignments totalling up to an equivalent of 3000 words during the semester (20%); a 3-hour written examination in the examination period (80%).

Prescribed Texts:	Classical Electromagnetism (R H Good), Saunders Spacetime Physics (E F Taylor and J A Wheeler), 2nd edn, Freeman
Breadth Options:	This subject is a level 2 or level 3 subject and is not available to new generation degree students as a breadth option in 2008. This subject or an equivalent will be available as breadth in the future. Breadth subjects are currently being developed and these existing subject details can be used as guide to the type of options that might be available. 2009 subjects to be offered as breadth will be finalised before re-enrolment for 2009 starts in early October.
Fees Information:	Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees
Notes:	This subject is available for science credit to students enrolled in the BSc (pre-2008 degree only), BASc or a combined BSc course.