# 640-213 Thermal and Classical Physics

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| **Credit Points:** | 12.50 |
| **Level:** | 2 (Undergraduate) |
| **Dates & Locations:** | 2009,<br>This subject commences in the following study period/s:<br>Semester 1, - Taught on campus.<br>Lectures, tutorials and practical laboratory classes. |
| **Time Commitment:** | Contact Hours: Three 1-hour lectures per week (total 27 lectures); one 1-hour tutorial per week (total 9 classes); one 3-hour laboratory class per week (total 6 classes). Total 54 hours. Total Time Commitment: 120 hours total time commitment. |
| **Prerequisites:** | One of<br># *Physics 1: Advanced*<br># *Physics 1*<br># *Physics 1: Fundamentals*<br>Plus one of<br># *Physics 2: Advanced*<br># *Physics 2: Physical Science and Technology*<br># *Physics 2: Life Sciences and Environment*<br>Plus one of<br># *Accelerated Mathematics 2* (620-158 Mathematics 2 prior to 2009)<br># *Calculus 2*<br>Plus one of<br># *Accelerated Mathematics 1* (620-157 Mathematics 1 prior to 2009)<br># *Linear Algebra* (may be taken concurrently). |
| **Corequisites:** | None |
| **Recommended Background Knowledge:** | None |
| **Non Allowed Subjects:** | 640-234, 640-223, 640-243. |
| **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. 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 coordinator and the Disability Liaison Unit. |
| **Coordinator:** | Dr Andrew Melatos |
| **Subject Overview:** | This subject extends knowledge of fundamental thermal physics principles and introduces the powerful and elegant Lagrangian and Hamiltonian formulations of classical mechanics. Topics from thermal physics include thermal equilibrium, ideal gas and kinetic theory, equipartition of energy, heat and work, heat capacity, latent heat, enthalpy, thermodynamic processes; thermal systems and statistics, interacting systems, statistics of large systems, entropy, temperature and heat, pressure, chemical potential; heat engines, Carnot cycle, refrigerators, throttling process; Helmholtz and Gibbs Free energies, and phase transformations. In classical physics, topics will include elementary principles (Newton's laws, momentum and energy conservation, mechanics of systems of particles), Lagrange's equations (constraints and generalized coordinates, Lagrange's equations, velocity dependent and dissipative forces, applications, symmetries and conservation laws, stability and oscillations) and Hamilton's principle (calculus of variation, applications, Hamilton's principle, Legendre transformations). |

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| **Objectives:** | To challenge students to expand their knowledge of fundamental physics principles and develop their capacity to:<br># discuss the principles underlying the zeroth, first and second laws of thermodynamics and calculate and interpret the thermodynamic properties of several simple systems.<br># solve problems in classical mechanics using the elegant Lagrangian and Hamiltonian formulations and understand that these principles will help them to gain a deeper insight into the relationship between classical and quantum mechanics.<br># acquire and interpret experimental data and perform computer modelling. |
| **Assessment:** | Ongoing assessment of practical work during the semester including:log-book record keeping and participation (10%)a written report of up to 2,000 words (10%) Satisfactory completion of practical work is necessary to pass the subject, including attendance and submission of work for at least 80% of workshop sessions, together with a result for assessed work of at least 50%.One written test with a total duration of up to 30 minutes, held mid semester (5%)Two written assignments requiring a total of up to 8 hours of work outside class time during the semester (10% in total)A 3-hour written examination in the examination period (65%) |
| **Prescribed Texts:** | D V Schroeder, An Introduction to Thermal Physics, Addison-Wesley Longman.A P Arye, Introduction to Classical Physics, Allen & Bacon. |
| **Breadth Options:** | This subject potentially can be taken as a breadth subject component for the following courses:<br># **Bachelor of Arts (https://handbook.unimelb.edu.au/view/2009/D09)**<br># **Bachelor of Commerce (https://handbook.unimelb.edu.au/view/2009/F04)**<br># **Bachelor of Environments (https://handbook.unimelb.edu.au/view/2009/A04)**<br># **Bachelor of Music (https://handbook.unimelb.edu.au/view/2009/M05)**<br>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:** | A student who completes this subject should be able to:<br># explain their understanding of physics principles and applications lucidly, both in writing and orally;<br># acquire and interpret experimental data and design experimental investigations;<br># participate as an effective member of a group in tutorial discussions, laboratory and study groups;<br># think independently and analytically, and direct his or her own learning;<br># manage time effectively in order to be prepared for regular practical and tutorial classes, tests, the examination and to complete assignments. |
| **Notes:** | Students enrolled in the BSc (both pre-2008 and new degrees), BASc or a combined BSc course will receive science credit for the completion of this subject. |