

Honours in Mathematics

The coordinator for the Fourth Year Honours program is Dr. A. Isaev, room JD 1183
Department of Mathematics
Mathematical Sciences Institute
E-mail: Alexander.Isaev@anu.edu.au

The Honours degree in Mathematics is the initial qualification towards becoming a professional mathematician. However, the rigorous training in mathematics provided by the Honours degree will be of great use to students intending to enter a wide variety of careers. In recent years, Honours graduates from this Department have gone on to higher degrees in Biology, Computer Science, Economics, Linguistics, Philosophy, Physics and Theoretical Physics, as well as further mathematical studies, and others have easily found attractive positions in industry, financial institutions and the public service. The Honours degree is taken over four years, the final year usually consisting of Mathematics courses and thesis work. Double Honours, in which two complete Honours programs are undertaken in successive years, are possible, the most likely combinations with Mathematics being Computer Science, Philosophy, Physics, Statistics, or Theoretical Physics.

Admission to the Honours program is granted at the end of the Third Year, but students intending to take Honours should have discussed this with staff at an early stage of their course.

For entry into the Fourth Year in Mathematics, students should have completed:

- (a) At least 48 units of B and C level Mathematics courses with a minimum grade of Credit (completion of units in a cognate subject may be taken into account) including at least 24 units of C level Mathematics courses.
- (b) Students must also have sufficient prerequisites to enable them to pursue an approved course of study in their fourth year. For instance student wishing to pursue a course of study in Fundamental Mathematics should include MATH3116 (or MATH2320) and MATH3104 (or MATH2322) in their program.
- (c) Faculty rules concerning entry into honours must be satisfied; see the Faculty Handbook for details.

Students who enter the ANU with direct entry to honours will be admitted to honours in Mathematics if they meet the relevant Faculty of Science requirements for these students. However, our strong recommendation is that students entering fourth year Mathematics Honours will do four Mathematics courses in the THIRD year. Failure to do so will make it very difficult to achieve a high level in the honours degree.

Part-time enrolment, with completion of the Honours program over two years is possible; the Fourth Year Honours Coordinator and the Faculty Office should be consulted for advice. It is also possible to commence the program in mid-year. Deferment of Honours

for one year may be granted by Faculty; students wishing to undertake further study in Mathematics after completing a Pass degree some time ago should consult the Faculty Office for advice.

Honours in Astronomy and Astrophysics

The Department of Mathematics and the Department of Physics offer a joint program which is particularly suited for students interested in pursuing a post-graduate career in astronomy or astrophysics. It also provides excellent training in the general areas of mathematical modelling, computing and modern instrument development. Lecture courses and honours project topics will be offered by members of the Research School of Astronomy and Astrophysics and the two departments; students enrolled in this program within the Department of Mathematics will fulfil the formal requirements of the Fourth Year Honours as for other mathematics students. Interested students should contact Professor D. Wickramasinghe for further details.

Honours in Computational Science

The Department of Mathematics and Department of Computer Science offer an honours program in computational science. This program is for people who are particularly interested in using computational modelling to simulate real world phenomena. Interested students should contact Dr Linda Stals for further details.

Organisation of the Honours program

The duration of the Fourth Year Honours program is approximately ten months; students will normally be required to be in attendance from late January-early February to mid-November (late June-early July to mid-June for mid-year entries). After consultation with staff members, each student will provide a plan of study for course and project work, to the satisfaction of the year coordinator. Any subsequent changes must be approved by the year coordinator.

Assessment of Fourth Year Honours will be on the basis of a project and coursework with equal weighting (performance in the two required seminars may also be taken into account). These weightings are to be used only as a guide; students' overall performance will be considered at the examiners' meeting in November (in June for mid-year entries). Examiners include all members of the Department and all external supervisors and lecturers. Assessment of coursework will be made in the usual manner. The project will be assessed by two examiners in accordance with the criteria listed below. Note that the ten month duration of the Honours course includes the time needed for assessment.

The Project

The topic for the project should be chosen in consultation with a supervisor during February (second half of June-first half of July for mid-year entries), or even earlier if possible. The student's supervisor may be expected to give close guidance throughout the

year; it is a good idea to schedule a set time each week to see one's supervisor, even if there is nothing in particular needing discussion at certain times. Note that the supervisor should not be expected to help with coursework or general problems not connected with the project; general problems should be referred to the year coordinator, coursework matters should be discussed with the lecturer. The result of the project is an essay which should normally have the form of an in-depth survey article. Perhaps the most effective way to find out what is acceptable is to view some of the essays which have been presented in previous years; they are located in the Departmental library, and (for recent years) can be accessed through the MSI website (MSI access only).

Points upon which the essay will be judged are:

- (i) the topic chosen should involve mathematics mainly outside available coursework and standard texts
- (ii) depth of understanding, not only of individual results but also their relationship to the subject as a whole
- (iii) familiarity with the literature and use of the library in background reading
- (iv) independence of outlook, usually in the area of synthesis of the literature into a cohesive account. Original mathematics is NOT required, and indeed supervisors should discourage their students from attempting original work at the beginning as being too uncertain an undertaking. However evidence of original ideas about the subject matter, its development and importance, will be considered crucial. Where direct quotes and close paraphrasing of other authors is considered desirable, complete references must be given.
- (v) style; mathematics is a human endeavour and the point of the essay is to communicate ideas. The essay must therefore be readable, with discussion illuminating the technicalities. The article by Halmos *How to write Mathematics* may be found useful.

The length of the essay will necessarily depend on the nature of the topic; however, 60 to 70 pages should be regarded as normal, less than 50 pages or more than 100 pages as unusual. The introduction to the essay should contain a statement indicating in general terms the sources of the results given, and any claims to originality in either results or methods. Three typed copies and a pdf file are to be submitted; the manuscript will usually be prepared using the TEX typesetting system which is available on University computer systems (the Department will be able to provide access to word-processing equipment for this purpose.). To allow time for assessment, the project must be completed and submitted approximately by the end of October (approximately by the middle of May for mid-year entries) -- for precise dates see the Students Information document at <http://www.maths.anu.edu.au/DoM/FourthYear/Resources>. Supervisors will expect a complete first draft to be in their hands in the first week of September (first week of April for mid-year entries). Possible Honours essay topics and supervisor can be found at www.maths.anu.edu.au/DoM/FourthYear

Coursework

A meeting will be held towards the end of the year with Third Year Honours students intending to continue to Fourth Year, to discuss possible courses for the following year. Courses totalling 24 units must be taken (you may attend more courses if you wish).

Seminars

Students will give two seminars during the course of the year. These are often on, or related to, the project, but may be on any mathematical topic (although at least one of the seminars must be related to the thesis topic). The purpose of the seminar is to give practice in delivering a lecture on a mathematical topic to a non-specialist mathematical audience, not to display one's erudition, that is, they should not be "snow jobs".

Points for judgement are:

- (i) organisation of material, clarity and suitability of the presentation for the audience mentioned
- (ii) timing — appropriate choice of material for the allotted time, including time for questions
- (iii) attention to mechanical details of lecture technique, such as audibility, board technique, judgement of audience comprehension, etc.

Your supervisor, or perhaps your colleagues, should audit a "dry run": you will almost certainly find that you vastly overestimate, at first, the amount of material which can be covered in one microcentury.

The seminars will commence soon after the beginning of classes. ALL students are expected to attend ALL of the seminars. Further you should note the weekly Mathematics Seminars held by the MSI; occasionally these may be specialised in nature and not appropriate to you, but frequently they will give you an opportunity to learn of the latest research methods in fields of interest to you, to hear an expository survey from an expert, or simply to meet a famous mathematician.

General

Fourth Year students will be provided with a desk in the John Dedman building and with computer accounts. E-mail accounts should be checked frequently for messages and seminar notices. Part-time tutoring is often available to Fourth Year students: contact the First Year Coordinator if you are interested.