ICE-EM Access Grid Room Project

Subject Information Form

Note: Subject Information form due at AMSI preferably **25 January 2013**
This form must be both electronically completed and transmitted.

Administration

1. Department and Institution **Department:** Mathematics and Statistics **Institution** La Trobe University

2. Subject name and code

   Subject name: Topology and Dynamics **Subject code:** MAT4TD

3. Handbook entry URL, subject homepage URL, host honours student hand-out URL

   - Handbook entry URL

     Go to `http://www.latrobe.edu.au/udb_public/publicview$.startup` and type in unit code MAT4TD.

   - Subject homepage URL

     Go to `https://www.latrobe.edu.au/lms/login/` and enter username and password (non Latrobe students will be issued an ad hoc username and password).

   - Host Honours student hand-out URL

     `http://www.latrobe.edu.au/__data/assets/pdf_file/0004/217867/mathematics-statistics-handbook-2013.pdf`

4. **Lecturer** name and contact details

Name:	John Banks
Phone:	(03) 9479 1062
Email:	J.Banks@latrobe.edu.au
Homepage:	`http://www.latrobe.edu.au/mathematics-and-statistics/about-the-department/our-staff/profile?uname=JDBanks`

5. **Honours coordinator** name and contact details

Name:	Marcel Jackson
Phone:	(03) 9479 1570
Email:	M.G.Jackson@latrobe.edu.au

6. Start date, end date, number of teaching weeks

Start date:	4 March
End date:	7 June
Number of teaching weeks:	13

7. Contact hours per week

   2 hours

8. Description of electronic access arrangements for students (for example, Black Board)

   La Trobe LMS (Moodle)

Academic

1. Overview of subject content

   We develop some definitions and results of very general application in *point set topology* and use them to explore the theory of (discrete time) *topological dynamics*. This will include an exploration of *chaos* and related dynamical properties. The point set topology is developed simultaneously with the topological dynamics and applications of the topology to the dynamics being added progressively as we proceed. There will be a strong focus on *symbolic dynamics* where we represent the state of a dynamical system as an infinite string of symbols drawn from a finite alphabet. In this context, we will see the connection between dynamical systems and the theory of *formal languages* which underpins much of theoretical computer science.

2. Detailed syllabus, preferably week by week (may vary slightly depending on mini-project topics chosen by students):

Week	Topology Topic(s)	Dynamics Topic(s)
1	Bases, Countability properties, Sub-bases.	Intro to discrete time dynamical systems.
2	Closure, Interior, Boundary,	Orbits, Periodic points.
3	Limits, Continuity, Homeomorphisms.	Invariant sets, Conjugacy.
4	Separation Properties, Metric Spaces.	Sensitive dependence.
5	Compactness and related concepts.	Attractors and repellors, Bifurcations.
6	Baire spaces.	Transitivity and related concepts, Chaos.
7	Connectedness and related concepts.	Dynamics of one-dimensional maps.
8	Finite products, Topological groups.	Group rotations.
9	Countable products	Symbolic dynamics and languages
10	General products and Tychonoffs Theorem	Shifts of finite type and Sofic shifts.
11	*Student presentations of mini-projects.*	Sofic shifts.
12	*Student presentations of mini-projects.*	Spacing shifts and return times.
13	*Student presentations of mini-projects.*	Inverse Limits.

3. Detailed breakdown of assumed prerequisite knowledge, including host prerequisite subject URLs

   (a) It is assumed students have already encountered the theory of point set topology and metric spaces including general definitions of:

   - Open, closed and dense sets and the closure of a set,
   - Continuity and convergence,
   - Hausdorff spaces,
   - Connectedness and path connectedness,
   - Compactness,
   - Basis for a topological space,
   - Finite product of topological spaces.

   and the standard theorems relating these concepts to one another.

   (b) Although some previous experience of these ideas is assumed, they will be revised as further definitions and results in point set topology are gradually introduced.

   (c) No previous study of dynamics is assumed.

   (d) Host prerequisite subject: MAT3TA, Topology and Analysis

   (e) Host prerequisite subject URL: Go to

   `http://www.latrobe.edu.au/udb_public/publicview$.startup`

   and type in unit code MAT3TA.

4. Assessment

   - Exam/assignment/class work breakdown

Exam	NA
Assignment	40 %
Class work	0 %
Mini-Project	60 %

   - Assignment due dates: April 12 (week 5) and May 17 (week 10).
   - Mini-project due June 14.
   - Approximate exam date: N/A

5. Required student resources

   - Comprehensive subject text *MAT4TD Topology and Dynamics* will be provided on-line (and as hard copy if requested).
   - There are no mandatory software requirements, but access to LATeX is desirable for mini-project.
   - Some kind of electronic whiteboard or tablet will be needed for student presentations.

Institutional Honours Details

1. Weight of subject in total honours assessment at host department

   12.5%

2. Thesis/subject split at host department

   Thesis 37.5% / Subjects 62.5%.

3. Honours grade ranges at host department

H1	=	80-100 %
H2a	=	70-79 %
H2b	=	60-69 %
H3	=	50-59 %