School of Mathematics

Module MA3421 — Functional analysis I 2010-11 (Optional JS & SS Mathematics, JS & SS Two-subject Moderatorship)

Lecturer: Professor Richard Timoney

Requirements/prerequisites: MA2223. MA2224 desirable.

Duration: Michaelmas term, 10 weeks

Number of lectures per week: 3 lectures including tutorials per week

Assessment: Regular assignments worth 15% of the grade.

ECTS credits: 5

End-of-year Examination: This module will be examined jointly with MA3422 in a 3-hour examination in Trinity term, except that those taking just one of the two modules will have a 2 hour examination. However there will be separate results for MA3421 and MA3422.

Description:

General Topology: Neighbourhoods, first countable, inadequacy of sequences, second- countable, (relationship to separability), continuity of functions at points, product topology (weak topology for continuous projections).

Partially ordered sets and the statement of Zorn's lemma. Applications (existence of bases, maximal ideals).

Nets, advantages over sequences, subnets; Hausdorff separation axiom, Urysohn's lemma, Tietze extension. Compactness via nets, Tychonoff's theorem (compactness of products).

Banach spaces: definitions and examples $(C(X), \ell^{\infty}, \text{ closed subspaces}, c_0)$.

Linear operators: examples of continuous inclusions among ℓ^p and $L^p[0, 1]$ spaces, *n*-dimensional normed spaces isomorphic. Open mapping and closed graph theorems. Uniform bound-edness principle.

Please see http://www.maths.tcd.ie/~richardt/MA3421 for more details.

Learning Outcomes: On successful completion of this module, students will be able to:

- give the appropriate definitions, theorems and proofs concerning the syllabus topics, including topics in general topology, elementary theory of Banach spaces and of linear operators;
- solve problems requiring manipulation or application of one or more of the concepts and results studied;
- formulate mathematical arguments in appropriately precise terms for the subject matter;

• apply their knowledge in mathematical domains where functional analytic techniques are relevant.

February 25, 2011