

School of Mathematics

Module MA3422 — Functional analysis II

2010-11

(Optional JS & SS Mathematics, JS & SS Two-subject Moderatorship)

Lecturer: Professor Richard Timoney

Requirements/prerequisites: prerequisite: MA3422

Duration: Hilary term, 10 weeks

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

Assessment:

ECTS credits:

End-of-year Examination: This module will be examined jointly with MA3421 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 MA3422 and MA3421.

Description:

Banach spaces Linear operators, operator norm, spaces of linear operators, dual spaces, operators on finite dimensional domains are continuous, finite dimensional spaces of the same dimension are isomorphic.

Major theorems Baire category theorem, Open mapping theorem, closed graph theorem, uniform boundedness principle, Hahn-Banach theorem, definition of reflexivity, examples of reflexive and non-reflexive space (also introducing ℓ^1 and ℓ^2).

Dual spaces: Hahn-Banach theorem, canonical isometric embedding in double dual, reflexivity.

Hilbert space: orthonormal bases (existence, countable if and only if separable), orthogonal complements, Hilbert space direct sums, bounded linear operators on a Hilbert space as a C^* -algebra.

Applications: Fourier series in $L^2[0, 2\pi]$.

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 the theory of linear operators and their norms, Baire category arguments, reflexivity, Hilbert space;
- 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