MA8006: FUNCTIONAL ANALYSIS AND APPLICATIONS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Functional Analysis and Applications

Subject Code
MA - Mathematics
Course Number
8006

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Part II Course Details

Abstract
This course aims to give research students a solid training in theory of classical and modern functional analysis. It also develops applications to the existence of solutions in boundary value and interpolation problems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain clearly properties of Banach and Hilbert spaces as well as bounded linear operators on such spaces	30%	x	x	

2	State and apply theorems of classical functional analysis, e.g. Hahn-Banach extension theorem, Baire category theorem, Banach closed graph theorem, etc. to mathematical problems	20%	x	x	x
3	Be familiar with concepts arising from weak topology, including weak convergence and weakly lower-semicontinuous functionals	10%	x	x	
4	Describe properties of some function spaces and their applications in analysis of boundary value problems	20%	x	x	
5	Apply concepts and techniques to classical problems of analysis and to demonstrate existence theorems for fundamental equations of mathematical physics	20%	x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Learning through teaching is primarily based on lectures	1, 2, 3, 4, 5	3 hours/week
2	Assignments	Learning through take-home assignments helps students implement more advanced theory and techniques of functional analysis, with applications in mathematical physi	1, 2, 3, 4, 5	After-class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Test	1, 2	35	Questions are designed for the first part of the course to see how well students have learned basic notions of functional analysis, including Banach and Hilbert spaces, bounded linear operators and the underlying main theorems.	No
2	Hand-in assignments	1, 2, 3, 4, 5	35	These are skills based assessment to help students understand advanced theory and techniques of functional analysis, and their applications in mathematical physics.	No

Continuous Assessment (%)

70

Examination (%)

30

Examination Duration (Hours)

3

Assessment Rubrics (AR)

Assessment Task

Test

Criterion

DEMONSTRATION of the understanding of the first part of the course

Excellent

High

Good

Significant

Marginal

Basic

Failure

Not even reaching marginal levels

Assessment Task
Hand-in assignments

Criterion
DEMONSTRATION of the understanding of the basic materials

Excellent
High

Good
Significant

Fair
Basic

Failure
Not even reaching marginal levels

Assessment Task
Examination

Criterion
DEMONSTRATION of skills and versatility in advanced theory as well as classical and modern functional analysis

Excellent
High

Good
Significant

Fair
Basic

Failure
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Banach spaces and Hilbert spaces, the “great theorems”: Hahn-Banach extension theorem, Baire theorem, Banach-Steinhaus theorem, Banach closed graph theorem, Banach closed range theorem.

Reading List