Course Syllabus

offered by Department of Mathematics
with effect from Semester A 2022/23

Part I Course Overview

Course Title:	Functional Analysis and Applications
Course Code:	MA8006
Course Duration:	One Semester
Credit Units:	3
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. 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.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Explain clearly properties of Banach and Hilbert spaces as well as bounded linear operators on such spaces	30%	✓	✓	
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%	✓	✓	✓
3.	Be familiar with concepts arising from weak topology, including weak convergence and weakly lower-semicontinuous functionals	10%	✓	✓	
4.	Describe properties of some function spaces and their applications in analysis of boundary value problems	20%	✓	✓	
5.	Apply concepts and techniques to classical problems of analysis and to demonstrate existence theorems for fundamental equations of mathematical physics	20%	✓	✓	✓
		100%			

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 self-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.

3. Teaching and Learning Activities (TLAs)

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

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.					Weighting*	Remarks
	1	2	3	4	5		
Continuous Assessment: 70%							
Test	✓	✓				0-35%	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.
Hand-in assignments	✓	✓	✓	✓	✓	35-70%	These are skills based assessment to help students understand advanced theory and techniques of functional analysis, and their applications in mathematical physics.
Examination: 30% (duration: 3 hours)	✓	✓	✓	✓	✓	30%	Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in advanced theory and techniques of classical and modern functional analysis.
						100%	

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-,C+,C)	Failure (F)
1. Test	DEMONSTRATION of the understanding of the first part of the course	High	Significant	Basic	Not even reaching marginal levels
2. Hand-in assignments	DEMONSTRATION of the understanding of the basic materials	High	Significant	Basic	Not even reaching marginal levels
3. Examination	DEMONSTRATION of skills and versatility in advanced theory as well as classical and modern functional analysis	High	Significant	Basic	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Test	DEMONSTRATION of the understanding of the first part of the course	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	DEMONSTRATION of the understanding of the basic materials	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	DEMONSTRATION of skills and versatility in advanced theory as well as classical and modern functional analysis	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. 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.

2. Reading List

2.1 Compulsory Readings

1.	
2.	
3.	
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2.2 Additional Readings

1.	
2.	
3.	
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