Grading Criteria for SF2705: Fourier Analysis

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Educational level:	Second cycle
Academic level (A-D):	D
Subject area:	Mathematics
Periods:	Spring 2018, P3-P4
Credits:	7.5 ECTS
Grade scale:	A, B, C, D, E, Fx, F

1. Intended learning outcomes

After passing the course, the students should be able to

- formulate central definitions and theorems of Fourier analysis;
- apply and generalize theorems and methods within Fourier analysis;
- describe, analyze and formulate basic proofs within Fourier analysis.

2. Course content

This course is structured in four learning units (learning cycles). Each unit consists of 4-5 lectures and 1 repetition session. Content of the units:

	Learning unit:	Content:
I	Fourier series and integrals in one variable:	*Convergence properties*: pointwise convergence, convergence in L^2, summation of Fourier series and integrals. *Convolution*: Theorems of Parseval and Plancherel.
II	Fourier series and integrals in several variable:	Fourier analysis in higher dimensions and on discrete Abelian groups.
III	Fourier analysis of analytic functions:	Hardy functions on the unit disk, Paley-Wiener Theorem, Hardy functions and filters.
IV	Applications:	Selection of the following: Heat equation, wave equation, isoperimetric inequality, Laplace equation on the unit disk and half-plane, Szegő's Theorem.

Table 1. Learning units and course content

3. Relation between ILOs and assessment tasks for SF2705

The assessment consists of four homeworks (formative assessments), and a written exam and an oral exam at the end of the semester (summative assessments). Relation between ILOs and assessments tasks is illustrated in Table 2.

Intended learning outcome:	Homework:	Written Exam:	Oral Exam:
Formulate central definitions and theorems:		x	
Apply and generalize theorems and methods:	x	x	x
Describe, analyze and formulate basic proofs:		x	x

Table 2. Relation between ILOs and assessment tasks

The first and third ILO will in addition be trained in the repetition units of each learning cycle without being assessed or graded in order to prepare students for the written exam.

4. Grading criteria for SF2705

Intended learning outcome:	Grading criteria for **Grade E**:	Grading criteria for **Grade D**:	Grading criteria for **Grade C**:	Grading criteria for **Grade B**:	Grading criteria for **Grade A**:
Formulate central definitions and theorems:	Quote and recall essential definitions and results of the course.				
Apply and generalize theorems and methods:	Apply theorems to simple problems, recognize examples where methods can be utilized.	In addition, apply Fourier analysis to intermediate advanced problems to some parts of the course.	In addition, apply Fourier analysis to intermediate advanced problems in several parts of the course.	In addition, apply Fourier analysis to solve advanced problems that combine several parts of the course; formulate generalizations; apply Fourier analysis to differential equations and explain basic concepts of wavelets *with hints.*	In addition, apply Fourier analysis to solve more advanced problems that combine several parts of the course; formulate and justify generalizations; apply Fourier analysis to differential equations and explain basic concepts of wavelets *without hints.*
Describe, analyze and formulate proofs:	Describe the proofs of elementary results *with hints.*	Describe the proofs of elementary results *without hints.*	Mathematically formulate proofs of intermediate advanced results *with hints.*	Mathematically formulate and analyze the proofs of results throughout the course and demonstrate insight into mathematical structure *with hints.*	Mathematically formulate and and analyze proofs of all results throughout the course and demonstrate insight into mathematical structure *without hints.*
The first learning outcome is assessed at level E only. The second and third learning outcomes are assessed at levels A-E.					

Table 3. Grading criteria

5. Assessment tasks and grade scales

The assessment consists of four homeworks (formative assessments), and a written exam and an oral exam at the end of the semester (summative assessments).

Homework: By solving homework problems correctly, students can earn bonus points for the written exam. Each of the four learning unit comprises one homework assignment with five problems of varying difficulty giving in total 50 points per assignment. Students who obtain at least 35 points in a homework assignment, will not have to do the corresponding part of Problem 3 of the written exam (see below) and automatically obtain the maximal number of points in the respective subproblem.

Written exam: Grades used in the written exam are C, D, E, Fx and F. The written examination consists of five problems, each giving at most 10 points. Time: 4 hours.

Design:

Problem 1:	Theoretical part assessing the competence to formulate definitions and theorems (first ILO). Max. 10 points.
Problem 2:	Theoretical part assessing the competence to describe proofs of results (third ILO). Three questions in total: Prove an elementary result with hints (5points), prove an elementary results without hints (2points) and prove one intermediate advanced result with hints (3points). Max. 10 points.
Problem 3:	Practical problem: Solve four simple problems each corresponding to a learning units (second ILO). Bonus points from homework apply as described above. Max. 10 points.
Problem 4-5:	Practical problems: Solve two intermediate advanced problems within several parts of the course (second ILO). Bonus points do not apply. Max. 10 points for each problem.

Grading scale:

Grade:	Points required:
Fx	At least 25 points in total
E	At least 25 points in total AND at least 5 points from Problem 1 AND at least 4 points from Problem 2.
D	At least 30 points in total AND at least 5 points from Problem 1 AND at least 6 points from Problem 2 AND at least 8 points from Problems 4-5 combined.
C	At least 35 points in total AND at least 5 points from Problem 1 AND at least 7 points from Problem 2 AND at least 6 points from Problem 4 AND at least 6 points from Problem 5.

Table 4. Grading scale written exam

Remark: AND is understood as logic symbol, i.e. all criteria must be met within a set to get the corresponding grade. The grade F is given if the criteria for grade Fx are not satisfied.

Remark: Students who achieve at least 25points in the written exam, but do not meet the point distribution in Problem 1 and Problem 2 for grade E, are given grade Fx. To convert grade Fx to E, students can take within six weeks after publication of results an additional oral examination to demonstrate that they meet all criteria for grade E. Else Fx will be converted to F.

Oral exam: Students who obtained grade C in the written examination, may take the individual oral exam of 20 minutes to enhance their grades to A or B.

Design: Students are asked by the examiner to

- solve one hard problem combining several parts of the course (second ILO);
- explain the proof of one theorem of the course (third ILO).

Grading scale:

Grade:	Grading criteria oral exam:
C	Solve none or one task with/without hints.
B	Solve both tasks with hints.
A	Solve both tasks independently without hints.

TABLE 5. Grading criteria oral exam

Final grade is given by the grade in the written exam (C,D,E,F), respectively by the grade in the exam (A,B,C), for those students who obtained C in the written exam and chose to take the oral exam.

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