Korszerű matematikai módszerek a geodéziában - BMEEOAFD001

I. Subject Specification

1. Basic Data

1.1 Title

Advanced Mathematics in Geodesy and Surveying

1.2 Code

BMEEOAFDT71

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	2

1.5 Evaluation

Exam

1.6 Credits

3

1.7 Coordinator

name	Dr. Gyula Károly Tóth
academic rank	Associate professor
email	toth.gyula@emk.bme.hu

1.8 Department

Department of Geodesy and Surveying

1.9 Website

https://epito.bme.hu/BMEEOAFD001
https://fiek2.mywire.org/course/view.php?id=663

1.10 Language of instruction

english

1.11 Curriculum requirements

Ph.D.

1.12 Prerequisites

1.13 Effective date

1 September 2022

2. Objectives and learning outcomes

2.1 Objectives

Goal of the subject is that the student be familiar with advanced applied mathematical methods that are widely used in geodesy and civil engineering and their fields of application. Knowledge acquired during this course should enable the student to understand and apply main mathematical methods that can be found in research papers in his field. Detailed practical examples help the application of the various methods studied.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. knows basics of data processing with continuous and discrete wavelets,
2. familiar with basics, main types and applications of Kalman filtering,
3. knows most important principles of digital filter design,
4. knowledgeable about most important pros and cons of various PSD estimation methods,
5. understands the merits of most frequent value procedures in comparison with traditional statistics,
6. can make distinction between traditional and bayesian statistical approaches.

B. Skills

1. can use robust and resistant data processing methodologies,
2. can routinely apply spectral estimation methods for data processing.

C. Attitudes

1. open to adopt recent mathematical methods in his field of research,
2. has a critical attitude towards the limits of widely used mathematical procedures,
3. quick to expand his knowledge

D. Autonomy and Responsibility

1. makes independent research decisions on the used mathematical procedures

2.3 Methods

lectures, interactive Jupyter notebooks

2.4 Course outline

Hét	Előadások és gyakorlatok témaköre
1.	Singular value decomposition (SVD), principal component analysis (PCA)
2.	Kalman filtering, derivation of the filter
3.	Extended Kalman filtering (EKF), unscented Kalman filtering (UKF)
4.	RANSAC estimation, ellipse, sphere, cylinder fitting
5.	Fourier transform, FFT, Fourier spectra of wheel accelerometry
6.	Continuous wavelet transform (CWT), wavelet filtering
7.	Discrete orthogonal wavelet transform (DWT)
8.	Digital filters, z-transform
9.	Parametric and nonparametric PSD estimation
10.	Basics of Bayesian statistics and its applications
11.	Most frequent value procedures (MFV) and its applications in geosciences
12.	Lattices, LLL lattice reduction, integer least squares
13.	Shifted linear interpolation
14.	Discussion of a topic proposed by students

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester. Consult the effective detailed course schedule of the course on the subject website.

2.5 Study materials

2.6 Other information

2.7 Consultation

This Subject Datasheet is valid for:

Nem induló tárgyak

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

3.2 Assessment methods

Teljesítményértékelés neve (típus)	Jele	Értékelt tanulási eredmények
exam	E	A.1-A.6; B.1-B.2; C.1-C.3; D.1

The dates of deadlines of assignments/homework can be found in the detailed course schedule on the subject's website.

3.3 Evaluation system

Jele	Részarány
E	**100%**
Összesen	**100%**

3.4 Requirements and validity of signature

3.5 Grading system

Érdemjegy	Pontszám (P)
jeles (5)	80<=P
jó (4)	70<=P<80%
közepes (3)	60<=P<70%
elégséges (2)	50<=P<60%
elégtelen (1)	P<50%

3.6 Retake and repeat

3.7 Estimated workload

Tevékenység	Óra/félév
contact hours	14×2=28
preparation for the examination	62
Összesen	**90**

3.8 Effective date

1 September 2022

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Nem induló tárgyak