

I. Tantárgyleírás

1. Alapadatok

1.1 Tantárgy neve

Hydrological modelling and forecasting

1.2 Azonosító (tantárgykód)

BMEEOVVDT82

1.3 Tantárgy jellege

Kontaktórás tanegység

1.4 Óraszámok

Típus	Óraszám / (nap)
Előadás (elmélet)	2

1.5 Tanulmányi teljesítményértékelés (minőségi értékelés) típusa

Vizsga

1.6 Kreditszám

3

1.7 Tárgyfelelős

név	Dr. József Szilágyi
beosztás	Egyetemi tanár
email	szilagyi.jozsef@emk.bme.hu

1.8 Tantárgyat gondozó oktatási szervezeti egység

Vízépítési és Vízgazdálkodási Tanszék

1.9 A tantárgy weblapja

<https://epito.bme.hu/BMEEOVVDT82>

<https://edu.epito.bme.hu/course/view.php?id=2499>

1.10 Az oktatás nyelve

magyar és angol

1.11 Tantárgy típusa

Ph.D.

1.12 Előkövetelmények

Recommended prerequisites:

- Modelling of Hydrosystems (BMEEOVVMV-1)
- Civil Engineering Informatics (BMEEOFTAT42)
- Hydrology II (BMEEOVVAI41)
- Numerical Methods (BMEEOFTMK51)
- Methods of Engineering Analysis (BMEEOHSMK51)

1.13 Tantárgyleírás érvényessége

2022. szeptember 1.

2. Célkitűzések és tanulási eredmények

2.1 Célkitűzések

The course will focus on time series and linear models most frequently employed in hydrology. Solution of the practical problems with the help of MATLAB will enable one to apply, modify and build such models on one's own for hydrological/civil engineering research.

2.2 Tanulási eredmények

A tantárgy sikeres teljesítése után a hallgató

A. Tudás

1. Familiarity with the most frequently encountered time series concepts and models employed in hydrological research and ability to apply them for one's own research.
2. Knows how to generate stochastic time-series with the Monte-Carlo approach.
3. Aware of the conditions necessary for applying the Kalman filter for optimal model parameter estimation.
4. Familiar with linear hydrological models and knows how to modify them for one's own purpose.

B. Képesség

1. Advanced problem solving capacity in hydrological modelling and forecasting using linear and time series models.
2. Thorough knowledge of linear models of hydrology, their modifications and problem-specific applications.
3. Thorough understanding of time series models often employed in hydrology and water resources research, their correct applications and strengthened skill to further develop such models.
4. Aptitude for writing MATLAB code performing „brute-force” calibration and its application for solving problems in hydrology and civil engineering.
5. Capacity of solving complex modelling problems by MATLAB.

C. Attitűd

1. Cooperates with the instructor during the learning process.
2. Continuously and actively seeks ways of gaining new knowledge even beyond the required curriculum and employs the internet for finding intuitive answers to research problems.
3. Open to learn new software skills.
4. Attempts to perform precise problem solutions.

D. Önállóság és felelősség

1. Resolution to solving homework on one's own within feasible limits.

2.3 Oktatási módszertan

Lectures on theory. Practical guidance about the steps needed for solving computational/modelling problems and the software required. Consultation of the homework individually or in groups using one's own laptop on top of written (e-mail) and personal oral communication during consultation hours.

2.4 Részletes tárgyprogram

Week	Topics of Lectures
1.	Stochastic process. Basics of time series modelling: stationarity, ergodicity.
2.	Univariate ARMA and ARIMA models.
3.	The seasonal Thomas-Fiering model and its applications.
4.	Multivariate AR models.
5.	Modelling non-stationary time-series.
6.	Data generation by the Monte-Carlo method and its hydrological applications.
7.	System theory. Linear ordinary differential equations. Impulse response and convolution. The Wiener-Hopf and Yule-Walker equations.
8.	The Saint-Venant equations and its simplified versions. State-space description of the continuous, spatially discrete linear kinematic wave equation. The Kalinin-Milyukov-Nash cascade.
9.	The Discrete Linear Cascade Model: classical pulsed data framework.
10.	The Discrete Linear Cascade Model: linearly interpolated data framework.
11.	The Boussinesq equation, the Diskin-Jakeman-Young rainfall-runoff model.
12.	The Gauss-Markov process.
13.	The Kalman filter and its application for model calibration.
14.	Accounting for nonlinearity using linear models. Geographic Information Systems and remote sensing applications in hydrology.

Due to holidays and recesses this course description is only for general guidance, the accurate time-table is found on the course's webpage, titled "Detailed semester schedule".

A félév közbeni munkaszüneti napok miatt a program csak tájékoztató jellegű, a pontos időpontokat a tárgy honlapján elérhető "Részletes féléves ütemterv" tartalmazza.

2.5 Tanulástámogató anyagok

a) Textbooks:

1. Szilágyi J., Szöllősi-Nagy A., 2010. Recursive streamflow forecasting: a state-space approach, CRC Press, London, UK.

2. Brockwell, P., 2010. Introduction to time-series and forecasting, Springer, New York, USA.
3. Bras, R. L., Rodriguez-Iturbe, I., 1993. Random functions and hydrology, Dover, London, UK.

2.6 Egyéb tudnivalók

2.7 Konzultációs lehetőségek

Time of consultations: advertised on the course's webpage (occasionally by specific request), in the office of the course instructor.

Jelen TAD az alábbi félévre érvényes:

2024/2025 semester II

II. Tárgykövetelmények

3. A tanulmányi teljesítmény ellenőrzése és értékelése

3.1 Általános szabályok

Evaluation of the participant's learning progress described in A 2.2. is performed by a written final test and ten homework assignments.

3.2 Teljesítményértékelési módszerek

Evaluation form	Abbreviation	Assessed learning outcomes
1st homework (partial performance evaluation)	HW1	B.1-B.2; C.1-C.4; D.1
2nd homework (partial performance evaluation)	HW2	B.1-B.2; C.1-C.4; D.1
3rd homework (partial performance evaluation)	HW3	B.1-B.2, B.5; C.1-C.4; D.1
4th homework (partial performance evaluation)	HW4	B.1-B.2, B.5; C.1-C.4; D.1
5th homework (partial performance evaluation)	HW5	B.1-B.2, B.5; C.1-C.4; D.1
6th homework (partial performance evaluation)	HW6	A.1; B.1-B.2, B.5; C.1-C.4; D.1
7th homework (partial performance evaluation)	HW7	B.1-B.2, B.5; C.1-C.4; D.1
8th homework (partial performance evaluation)	HW8	A.2-A.3; B.1-B.4; C.1-C.4; D.1
9th homework (partial performance evaluation)	HW9	A.4; B.1-B.5; C.1-C.4; D.1
10th homework (partial performance evaluation)	HW10	B.5
Written test (final performance evaluation)	WT	B.1-B.5

A szorgalmi időszakban tartott értékelések pontos idejét, a házi feladatok ki- és beadási határidejét a "Részletes féléves ütemterv" tartalmazza, mely elérhető a tárgy honlapján.

3.3 Teljesítményértékelések részaránya a minősítésben

Abbreviation	Score
HW	70%
WT	30%
Sum	100 %

3.4 Az aláírás megszerzésének feltétele, az aláírás érvényessége

Non-relevant.

3.5 Érdemjegy megállapítása

Grade	Points (P)

Hydrological modelling and forecasting - BMEEOVVDT82

excellent (5)	$85\% \leq P$
good (4)	$70\% \leq P < 85\%$
average (3)	$55\% \leq P < 70\%$
satisfactory (2)	$40\% \leq P < 55\%$
unsatisfactory (1)	$P < 40\%$

3.6 Javítás és pótlás

1. The homework is due back within two weeks always.
2. The homework can be corrected within that time limit.
3. There is a make-up test in the 15th week of the semester.

3.7 A tantárgy elvégzéséhez szükséges tanulmányi munka

Activity	Hours/semester
participation in contact classes	$14 \times 2 = 28$
preparation for the final test	8
preparation of homework	$10 \times 4 = 40$
study from notes, textbooks	14
Sum	90

3.8 A tárgykövetelmények érvényessége

2022. szeptember 1.

Jelen TAD az alábbi félévre érvényes:

2024/2025 semester II