COURSE SYLLABUS AND COURSE REQUIREMENTS
ACADEMIC YEAR 2022/2023 SEMESTER AUTUMN

Course title	*Applied Mathematics 2.*
Course Code	IVB008NAMI
Hours/Week: le/pr/lab	2/2/0
Credits	6
Degree Programme	BSc
Study Mode	*Full-time*
Requirement type	Exam
Teaching Period	Autumn
Prerequisites	
Department(s)	Department of Engineering Mathematics
Course Director	Prof. Dr. Mihály KLINCSIK
Teaching Staff	*Ákos PILGERMÁJER*

COURSE DESCRIPTION

A brief description of the course (max. 10 sentences).
Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description

The course introduces important mathematical techniques of exercise solving and the basic theory of probability and statistics. Equal emphasis is given to learning new mathematics and how to construct and write down correct mathematical arguments. We will discuss modelling and analysis of engineering problems under uncertainty, engineering applications of probability and statistical concepts and methods.

- Understand the concepts of probability and statistics.
- Acquire basic knowledge of fundamental probability distributions, discrete and continuous, univariate and multi-variate.
- Estimate and interpret correlation coefficient.
- Carry out point and interval estimations involving normal populations.
- Understand hypothesis testing and the meaning of the null hypothesis.
- Understand regression analysis and data fitting by using least square method.

SYLLABUS

Neptun: Instruction/Subjects/Subject Details/Syllabus

1. GOALS AND OBJECTIVES

Goals, student learning outcome.
Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction

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2. COURSE CONTENT

Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content

	TOPICS
LECTURE	1. Elements of probability theory. 2. Classical probability space, counting techniques. Counterexamples. 3. Conditional probability, law of total probability, Bayes' theorem. 4. Random variables and their properties. 5. Mean, median, mode, expectation, variance, quantiles, percentiles, quartiles. 6. Joint random variables, joint-PDF, joint-CDF, marginal distributions. Conditional distributions, independence of random variables.

	7. Covariance, correlation, transformations, standardization of random variables. 8. Special discrete distributions: binomial, geometric, hypergeometric, Poisson. 9. Autumn break. 10. Special continuous distributions: uniform, exponential, normal (Gauss). Central role of the normal distribution. Markov's, Chebyshev's inequality. Law of large numbers, central limit theorem (CLT). 11. Descriptive statistics. Experimentation, data representation, sample statistics. 12. Point estimation and its properties. Confidence intervals, hypothesis testing. 13. Regression analysis and data fitting by using least square method. Goodness of fit tests.
PRACTICE	1. Elements of probability theory. 2. Classical probability space, counting techniques. Counterexamples. 3. Conditional probability, law of total probability, Bayes' theorem. 4. Random variables and their properties. 5. Mean, median, mode, expectation, variance, quantiles, percentiles, quartiles. 6. Joint random variables, joint-PDF, joint-CDF, marginal distributions. Conditional distributions, independence of random variables. 7. Covariance, correlation, transformations, standardization of random variables. 8. Special discrete distributions: binomial, geometric, hypergeometric, Poisson. 9. Autumn break. 10. Special continuous distributions: uniform, exponential, normal (Gauss). Central role of the normal distribution. Markov's, Chebyshev's inequality. Law of large numbers, central limit theorem (CLT). 11. Descriptive statistics. Experimentation, data representation, sample statistics. 12. Point estimation and its properties. Confidence intervals, hypothesis testing. 13. Regression analysis and data fitting by using least square method. Goodness of fit tests.
LABORATORY PRACTICE	*None.*

DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

LECTURE

week	Topic	Compulsory reading; page number (from … to …)	Required tasks (assignments, tests, etc.)	Completion date, due date
1.	Elementary probability theory: random experiment, outcomes, sample space (set of outcomes), algebra of events (mutually exclusive events, partitions), probability space. Kolmogorov's axioms.	…	…	…
2.	Classical probability space, counting techniques. Counterexamples.			
3.	Conditional probability, multiplication law of probabilities, independent events, law of total probability, Bayes' theorem, decision tree and its inverse.			

4.	Random variables. Probability mass function (PMF), cumulative density function (CDF) of disctrete, probability density function (PDF), CDF of continuous random variables.			
5.	Mean, median, mode, expectation, variance, quantiles, percentiles, quartiles.			
6.	Joint random variables, joint-PDF, joint-CDF, marginal distributions. Conditional distributions, independence of random variables.			
7.	Covariance, correlation, transformations, standardization of random variables.			
8.	Special discrete distributions: binomial, geometric, hypergeometric, Poisson.			
9.	Autumn break.			
10.	Special continuous distributions: uniform, exponential, normal (Gauss). Central role of the normal distribution. Markov's, Chebyshev's inequality. Law of large numbers, central limit theorem (CLT).			
11.	Descriptive statistics. Experimentation, data representation, sample statistics.			
12.	Point estimation and its properties. Confidence intervals, hypothesis testing.			
13.	Regression analysis and data fitting by using least square method. Goodness of fit tests.			
14.	Consultation			
15.	Consultation			

PRACTICE, LABORATORY PRACTICE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Random variables. Probability mass function (PMF), cumulative density function (CDF) of disctrete, probability density function (PDF), CDF of continuous random variables.			
2.	Classical probability space, counting techniques. Counterexamples.			
3.	Conditional probability, multiplication law of probabilities, independent events, law of total probability, Bayes' theorem, decision tree and its inverse.		HW1	Next Tuesday 20.00 in Teams

4.	**First midterm test (MTT1)**		MTT1	In practice time
5.	Mean, median, mode, expectation, variance, quantiles, percentiles, quartiles.			
6.	Joint random variables, joint-PDF, joint-CDF, marginal distributions. Conditional distributions, independence of random variables.			
7.	Covariance, correlation, transformations, standardization of random variables.			
8.	Special discrete distributions: binomial, geometric, hypergeometric, Poisson.			
9.	Autumn break.			
10.	Special continuous distributions: uniform, exponential, normal (Gauss). Central role of the normal distribution. Markov's, Chebyshev's inequality. Law of large numbers, central limit theorem (CLT).		HW2	Next Tuesday 20.00 in Teams
11.	**MTT2**		MTT2	In practice time
12.	Point estimation and its properties. Confidence intervals, hypothesis testing.			
13.	Regression analysis and data fitting by using least square method. Goodness of fit tests.		HW3	Next Tuesday 20.00 in Teams
14.	**MTT3**		MTT3	In practice time
15.	Retakes.		Retakes	In all classes

3. ASSESSMENT AND EVALUATION

(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)

ATTENDANCE

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Method for monitoring attendance *(e.g.: attendance sheet / online test/ register, etc.)*

attendance sheet / online test

ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

Course-unit with final examination

Mid-term assessments, performance evaluation and their weighting as a pre-requisite for taking the final exam

(The samples in the table to be deleted.)

Type	Assessment	*Weighting as a proportion of the pre-requisite for taking the exam*
MTT1	max 30 points	20 %

MTT2	max 60 points	40 %
MTT3	max 30 points	20 %
Homeworks	max 30 points	20 %

Requirements for the end-of-semester signature

(Eg.: mid-term assessment of 40%)

During the semester there will be compulsory midterm tests and homeworks.

Homeworks will be formative assessments. They are to practice basic computational methods, develop necessary attitudes, serve as (self)check in continuous development and support preparation for midterm tests.

Midterm tests will be summative assessments. They must be done in time in a controlled environment. If one cannot take a midterm test (at most one of them), she must note the instructor (Ákos Pilgermájer) in advance and must retake it in an agreed date.

Signature

The student get the course signature if and only if the following conditions are met:

- For all midterm tests (or their retakes) one must reach at least 40%
- 'midtermresult%' must be at least 40%, where

'midtermresult%' = 0.7*('midterm tests%') + 0.3*('homeworks%').

If 'midtermresult%'<40% even with retakes or more than one MTT is not written in time, the student does not earn the signature, thus fails the course.

Re-takes for the end-of-semester signature (PTE TVSz 50§(2))

The specific regulations for grade betterment and re-take must be read and applied according to the general Code of Studies and Examinations. E.g.: all the tests and the records to be submitted can be repeated/improved each at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

Only one missed or the worst written MTT can be made up. Retakes are planned for the last week of semester, but after each MTT we can agree on an earlier date if that is applicable.

Type of examination *(written, oral):* *written*

Only those can take an exam who have signature.

The exam is successful if the result is minimum 40 %. *(The minimum cannot exceed 40%.)*

Calculation of the grade *(TVSz 47§ (3))*

Offered grade (without exam):

If someone reaches at least 70% at first for all midterm tests, an offered grade (must be accepted in Neptun system) is provided by means of the '**midtermresult%'.**

(With) exam:

Who cannot earn offered grade or does not accept it must take an exam. The mid-term performance accounts for 50 %, the performance at the exam accounts for 50 % in the calculation of the final grade.

Calculation of the final grade based on aggregate performance in percentage.

Course grade	Performance in %
excellent (5)	85 % …
good (4)	70 % ... 85 %
satisfactory (3)	55 % ... 70 %
pass (2)	40 % ... 55 %
fail (1)	below 40 %

The lower limit given at each grade belongs to that grade.

4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

COMPULSORY READING AND AVAILABILITY

[AH] Anthony Hayter, *Probability and Statistics for Engineers and Scientists, 4th edition, 2012, Brooks/Cole, Cengage Learning*

RECOMMENDED LITERATURE AND AVAILABILITY

[RAND] randomservices.org

[EL] Moodle and TEAMS course materials