

SUBJECT DETAILS AND SYLLABUS
2019/2020. 1. SEMESTER

<i>Subject name</i>	Engineering Mathematics 3.
<i>Subject code</i>	MSB295ANEP
<i>Classes per week (L/P/Lab)</i>	1/2/0
<i>Number of Credits</i>	3
<i>Program</i>	full-time
<i>Division</i>	civil engineering
<i>Requirement type</i>	mid-term grade
<i>Semester</i>	2019/2020. 1. semester
<i>Preliminary requirements</i>	Engineering Mathematics 2
<i>Organization name</i>	Department of Engineering Mathematics
<i>Responsible lecturer name</i>	Ildikó Perjési-Hámori PhD

<i>Instructor</i>	Ákos Pilgermájer
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GOAL OF INSTRUCTION

The presentations give some elements of important mathematical techniques which is used in civil engineering practice.

Upon completion of this course the student should be able to:

- a. **interpret**, and **put into practice** first- and second order ordinary differential equations (ODEs),
- b. **model** and **analyse** problems where random comes into consideration,
- c. **apply** quantities of descriptive statistics to **describe** data sets,
- d. **interpret** and **implement** basic **statistical computations** of inferential statistics.

SUBJECT CONTENT

Brief Syllabus: This lecture and laboratory work based course aims to give engineering students a solid mathematics basis through covering the following topics:

- *Elements of ordinary differential equations:* classification, types of solutions, analytical solution of first order, separable and linear differential equations, solution of second order incomplete and linear with constant coefficients ODEs,

- *Elements of probability:*
 - Classical probability: random events, experiments, sample space, computing probability with combinatorial, geometrical methods, conditional probability and independence, Bayes' theorem and the law of total probability,
 - *Random variables:* discrete and continuous random variables, transformations of random variables, expectation and variance and their properties, Markov's, Chebishev's inequality, law of large numbers, central limit theorem, joint and marginal random variables, independence, covariance, correlation,
- *Elements of statistics:*
 - elements of descriptive statistics, commonly used quantities
 - inferential statistics: point estimation of mean and variance, interval estimation: confidence interval for the mean in case of normal populations, statistical tests of samples, hypothesis and its alternative(s), errors, linear regression and correlation, goodness of regression by chi-square test.

Planned Schedule

Tuesdays 7.45-9.15:

1. No lecture.
2. First-order, separable and linear ODEs, Lagrange's method, IVPs.
3. No lecture.
4. **Mid-term test 1** (45 mins). Combinatorial primer.
5. No lecture.
6. Conditional probability, independence, Bayes' theorem, the law of total probability.
7. No lecture.
8. **Mid-term test 2** (90 mins).
9. No lecture. (Autumn break)
10. Exercises on random variables: find mass, distribution, density functions, compute probabilities, expected values and variances.
11. No lecture.
12. Compute joint and marginal distribution, density functions, (conditional) probabilities and expected values, check independence.
13. No lecture.
14. **Mid-term test 3** (90 mins).
15. **Consultation for corrections.**

Wednesdays 7.45-9.15:

1. Discussing the syllabus. Engineering examples of ODEs, types, solutions.
2. Second-order, incomplete and constant coefficient linear homogenous ODEs
3. Second-order, linear, non-homogenous ODEs with constant coefficients: method of undetermined coefficients, **consultation for mid-term test 1.**
4. Random experiment, outcomes, sample space, algebra of events, axioms of probability, probability space; sum and product rule, case of equally likely outcomes, geometric method.

5. Operations on events and computing their probability, combinatorial exercises, computing classical, geometric probability.
6. Exercises for conditional probability, application of decision trees, checking independence.
7. Random variables, distribution and density functions, expectation and variance, transformations, moments, **mid-term test 2 consultation.**
8. No practice. (National holiday)
9. No practice. (Autumn break)
10. Examples of the most important distributions.
11. Markov's, Chebyshev's inequality, law of large numbers, central limit theorem; joint and marginal random variables, conditional expected value, independence, covariance, correlation.
12. Point estimations for mean and variance, confidence interval for the mean in case of normal populations, statistical tests of samples, hypothesis and its alternative(s), errors, goodness of regression by means of chi-square test, linear regression and correlation.
13. **Mid-term test 3 consultation.**
14. **Consultation for corrections.**
15. **Correction of the worst test. (The least percentage.)**

Exam period

1. **Last, overall correction.**

EXAMINATION AND EVALUATION SYSTEM

Attendance:

Attending is required all classes, and will impact the grade (max. 10%). Unexcused absences will adversely affect the grade, and in case of absence from more than 30% of the total number of lessons will be grounds for failing the class. To be in class at the beginning time and stay until the scheduled end of the lesson is required, tardiness of more than 15 minutes will be counted as an absence. In the case of an illness or family emergency, the student must present a valid excuse, such as a doctor's note.

Grading

The final result will be calculated as the arithmetic average of midterm tests modified by the above described percentage of attendance. Grading is as:

Grading Scale:

Numeric Grade:	5	4	3	2	1
Evaluation:	89%-100%	77%-88%	66%-76%	51%-65%	0-50%

LITERATURE

- [1] SHELDON M. ROSS, INTRODUCTION TO PROBABILITY AND STATISTICS FOR ENGINEERS AND SCIENTISTS, 2ND EDITION, ELSEVIER ACADEMIC PRESS, 2004.
- [2] SUBJECT MATERIALS ON NEPTUN MEET STREET
- [3] RANDOMSERVICES.ORG

SCHEDULE

	STUDY PERIOD, STUDY WEEKS															EXAM PERIOD				
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	1.	2.	3.	4.	5.
2018/2019. 2. SEMESTER																				
Lecture		X		X		X		X		X		X		X						
Practice	X	X	X	X	X	X	X			X	X	X	X	X	X					
Midterm test				X				X						X						
Corrections															X	X				
Grade																	X			

02/09/2019 Pécs

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Ákos Pilgermájer lecturer

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Ildikó Perjésiné-Hámori responsible lecturer