



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Selected topics in mathematics [S2MwT1>WZzM]

### Course

Field of study

Mathematics in Technology

Year/Semester

1/1

Area of study (specialization)

–

Profile of study

general academic

Level of study

second-cycle

Course offered in

polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

0

Tutorials

30

Projects/seminars

0

### Number of credit points

4,00

### Coordinators

dr Leszek Wittenbeck

leszek.wittenbeck@put.poznan.pl

### Lecturers

### Prerequisites

1. The elementary knowledge from the calculus and the ordinary differential equations. 2. The efficient ability to derivate, analyse function of one variable, integrate, solve ordinary differential equations. 3. The awareness of the importance of skills and the ability to cooperate with the others.

### Course objective

The understanding of the elementary aspects of the calculus of variation. The familiarising with examples of the variational problems and making intelligible about the necessary and sufficient conditions for the extremum of a functional.

### Course-related learning outcomes

Knowledge:

1. The student understands the basic concepts and methods of proving important theorems, knows the analogy between the extremum of a functional and the extremum of a function [K\_W01].
2. The student knows the advanced calculation techniques which improve the work of a mathematician and understand their constraints [K\_W02, KW03].

## Skills:

1. The student can use knowledge of the calculus and ordinary differential equations [K\_U01].
2. The student can use various forms of mathematical reasoning in the field of the calculus of variation [K\_U05].
3. The student can show the natural examples of the variational problems [K\_U10]

## Social competences:

1. The student is aware of the need to deepen and expand his knowledge [K\_K02].
2. The student is aware of the social role as a graduate of a technical university, is ready to pass on popular science content to the public and to identify and resolve basic problems related to the field of study [K\_K05].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:

### Lecture:

1. Evaluation of knowledge and skills on the written test.

<50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb

### Tutorials:

1. Two written test.

2. Engagement in discussion and cooperation in solving exercises.

<50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb

## Programme content

1. Examples of the variational problems defined by functional integral .
2. The necessary condition for the extremum of a functional - Euler-Lagrange equation.
3. Analogy between the extremum of a functional and the extremum of a function.
4. Special cases of the Euler-Lagrange equation.

## Teaching methods

### Lecture:

1. Interactive lecture with formulation questions to a group of students or to specific students indicated.
2. Initiation of discussion during lecture.
3. Theory presented in connection with current knowledge students.

### Tutorials:

1. Solving example tasks on the board.

2. Detailed review of task solutions and discussions on comments.

3. Initiate discussion on solutions.

## Bibliography

### Basic

1. I. M. Gelfand i S. W. Fomin, Rachunek wariacyjny, Państwowe Wydawnictwo Naukowe, Warszawa, 1972.

2. J. Musielak, Wstęp do analizy funkcjonalnej, Państwowe Wydawnictwo Naukowe, Warszawa, 1989.

### Additional

1. R. Weinstock, Calculus of Variations, McGraw-Hill Book Company Inc., 1952

## Breakdown of average student's workload

	Hours	ECTS
Total workload	105	4,00
Classes requiring direct contact with the teacher	65	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	2,00