COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics [S2Bud1E>MAT]

Course

Field of study
Civil Engineering

Year/Semester
1/1

Area of study (specialization)
Structural Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge with range of differential and integral calculus, ordinary differential equations, linear algebra and analytical geometry (from first degree studies).

Course objective

The main aim of the course is the understanding of basic notions of the theory in order to apply them to solving technics problems, finding general and particle solutions of partial differential equations of first and second order, finding Fourier series and Fourier transforms of a given function, solving boundary problems and boundary-initial problems of partial differentiable equations by applying Fourier transforms and Fourier series, understanding basic notions of calculus of variations (minimum of functional, extremizing function, the Euler-Lagrange equation)

Course-related learning outcomes

Knowledge:
1. Student has extended and detailed knowledge of mathematics and mathematical statistics, forming theoretical principles appropriate to formulate and solve tasks related to building engineering
2. Student has structured and theoretically based knowledge of the processes in the full life cycle of

building structures and their management rules. They also know and understand the need for systematic evaluation and maintenance of structure technical condition

Skills:
1. Student is able to plan and perform lab experiments, using suitable methods and tools for evaluating the quality of applied materials and evaluating the strength of elements of selected building structures
2. Student, by utilizing the obtained knowledge, can select appropriate (analytical, numerical, simulation, experimental) methods and tools to solve technical problems
3. Student, by applying scientific rules and skills, is able to formulate and test hypotheses related to simple research problems, in order to solve engineering, technological and organisational problems in construction engineering; can prepare studies preparing for research work
4. Student can manage team work, cooperate with other people and take the leading part in teams

Social competences:
1. Student takes responsibility for the reliability of working results and their interpretation
2. Student can realise that it is necessary to improve professional and personal competence; is ready to critically evaluate the knowledge and received content
3. Student is ready to obey the principles of professional ethics

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The lecture:
- written exam concerning mainly the theoretic part of the subject.

Classes:
- evaluation of written tests and the direct activity during the classes (solving problems and preparing reports)
- continuous evaluation during each meeting - taking into account the activity in discussion and in cooperation concerning practical exercises.
Getting extra points related with activity, in partucular:
-presenting reports concerning applications of theory in different branches or putting the theory in history of mathematics
-notes concerning the improvement of basic materials;
-active participation in consultations

Programme content

I. Partial differential equations
II. Fourier series and Fourier transforms
III. Calculus of variations

Course topics

I. Partial differential equations
1. Basic notions
2. The boundary and initial conditions
3. Linear partial differential equations of first order
4. Partial differential equations of second order (canonical form, the most known examples, conversion to the canonical form)
II. Fourier series and Fourier transforms
1. Separating of variables as justification for the theory of Fourier series
2. Approximating the function by a trigonometric series.
3. Fourier series of a given function, Fourier sine (cosine) series, Fourier series expansion in the interval [-l,l], Fourier series in a complex form
4. Fourier integral of a function f absolutely integrable on R
5. Sine, cosine and complex Fourier transform
6. Fundamental properties of Fourier transform useful in applications
7. Applications of Fourier series and Fourier transforms to differential equations, algorithm of finding solution of differential equations by Fourier transforms

III. Calculus of variations
1. Several examples which lead to variational problems defined by integral functional
2. The necessary condition for minimizing problem - the Euler-Lagrange equation
3. Analogies between the extremum of a real valued function on a real line and the extremum of a functional.
4. Finding of an extremizing function in several classical problems.

Teaching methods

Lectures:
1. lecture led in interactive way with questions formulating to group,
2. the students' activity is taken into account during the final evaluation (the preparation of historical reports connected with the mathematicians' related to material),
3. in track of lecture initiating the discussion,
4. theory presented with connections of current knowledge from previous lectures.
Classes:
1. solving on board example tasks,
2. detailed the reviewing by leader the solutions of tasks of practice and the discussions over comments,
3. the students' activity is taken into account during the final evaluation.

Bibliography

Basic bibliography:
1. R. Leitner i J. Zacharski, Zarys matematyki wyższej dla studentów cz. 3, Wydawnictwo Naukowo-Techniczne , Warszawa, 1998.
2. R. Leitner, Zarys matematyki wyższej dla studentów cz. 2, Wydawnictwo Naukowo-Techniczne , Warszawa, 1998.
3. W. Krysicki i L. Włodarski, Analiza matematyczna w zadaniach cz.2, Państwowe Wydawnictwo Naukowe, Warszawa, 1974.
4. T. Trajdos, Matematyka dla inżynierów, Wydawnictwo Naukowo-Techniczne, Warszawa, 1974.
5. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1 Definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław, 2003.
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9. I. M. Gelfand i S.W. Fomin, Rachunek wariacyjny, Państwowe Wydawnictwo Naukowe, Warszawa, 1972.

Additional bibliography:
1. D. L. Powers, Elementary Differential Equations with Boundary Value Problems, PWS Publishers (a division of Wadsworth) Inc., Boston 1985.
2. E. W. Swokowski, Calculus with analytic geometry, PWS Publishers (a division of Wadsworth) Inc., Boston 1983.
3. M. Itskov, Tensor Algebra and Tensor Analysis for Engineers with Applications to Continuum Mechanics, Springer-Verlag, Berlin Heidelberg New York, 2007.
4. D. J. Hartfiel, Elementary Linear Algebra, PWS Publishers (a division of Wadsworth) Inc., Boston 1987.
5. G. E. Mase, Theory and Problems of Continuum Mechanics, McGraw-Hill Company Inc., 1970.
6. G. T. Mase and G. E. Mase, Continuum Mechanics for Engeneers, CRC Press LLC, London New York Washington 1999.
7. Tyn Myint-U, Partial Differential Equations of Mathematical Physics, American Elesevier Publishing Co.,Inc., 1973.
8. H. F. Wienberger, A First Course in Partial Differential Equations, John Wiley&Sons Inc., 1965.
9. S. Vent, W. Bishop, Elementary Linear Algebra, second edition, PWS Publishers, Boston-USA, 1985.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50