FACULTY OF ELECTRICAL ENGINEERING

# SUBJECT CARD

| | |
|---|---|
| Name in Polish: | **Elementy analizy wektorowej** |
| Name in English: | **Elements of Vector Analysis** |
| Main field of study (if applicable): | **Electrical Engineering** |
| Specialization (if applicable): | |
| Level and form of studies: | **1st level, part-time** |
| Kind of subject: | **obligatory / university-wide** |
| Subject code: | **MAT001733** |
| Group of courses: | **NO** |

| | Lecture | Classes | Laboratory | Project | Seminar |
|---|---|---|---|---|---|
| Number of hours of organized classes in University (ZZU): | 11 | 11 | | | |
| Number of hours of total student workload (CNPS): | 60 | 60 | | | |
| Form of crediting: | crediting with grade | crediting with grade | | | |
| For group of courses mark (X) final course: | | | | | |
| Number of ECTS points: | 2 | 2 | | | |
| including number of ECTS points for practical (P) classes : | | 2 | | | |
| including number of ECTS points for direct teacher-student contact (BK) classes: | 1.40 | 1.40 | | | |

## PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of differential calculus of functions of one and several variables
2. Knowledge of integral calculus of functions of variable and multiple integrals.

## SUBJECT OBJECTIVES

C1. Exposition of a construction of line and surface integrals and presentation of their applications to engineering calculus.
C2. Presentation of some elements of vector calculus.

## SUBJECT LEARNING OUTCOMES

*relating to knowledge:*

PEU_W01 knows definition and basic properties of line and surface integrals and their applications,
PEU_W02 knows basic properties of differential operators of scalar functions and vector fields.

*relating to skills:*

PEU_U01 can calculate line and surface integrals of scalar functions and vector fields and is able to apply them in engineering problems,
PEU_U02 is able to apply methods of vector analysis in engineering problems,

*relating to social competences:*

PEU_K01 understands the need for systematic and independent work on mastery of course material,

## PROGRAMME CONTENT

| | Form of classes - lecture | Number of hours: |
|---|---|---|
| Lec 1 | Curves on plane and in space. Definition and basic properties of line integrals of scalar functions along curves (path integrals). Reduction of line integrals of scalar functions to single integrals. Applications of path integrals. | 2 |
| Lec 2 | Definition and basic properties of line integrals of vector fields. Reduction of line integrals of vector fields to single integrals.Independence of line integrals of vector fields from the integration path. Green`s theorem. Applications of line integrals of vector fields. | 3 |
| Lec 3 | Surfaces. Definition and basic properties of surface integrals of scalar functions. Reduction of surface integrals of scalar functions to double integrals. Application of surface integrals of scalar functions. | 3 |
| Lec 4 | Definitions and basic properties of surface integrals of vector fields. Reduction of surface integrals of vector fields to double integral. Elements of vector calculus. Gauss's theorem. Stoke's theorem. Applications of surface integrals of vector fields. integrals of vector fields in geometry and engineering. Test. | 3 |
| | Total hours: | **11** |

| Form of classes - class | | Number of hours: |
|---|---|---|
| Cl 1 | Path integral calculations. Applications of path integrals in geometry and engineering. | 2 |
| Cl 2 | Calculation of line integrals of vector fields. Independence testing for integrals and their integration paths. Potential determining. Applications of Green's theorem. Examples of line integrals of vector fields applications to engineering calculus | 3 |
| Cl 3 | Surface integral calculations. Applications of surface integrals of scalar functions in geometry and engineering. | 2 |
| Cl 4 | Calculation of surface integrals of vector fields. Independence testing for integrals and their integration paths. Potential determining. Applications of Green's theorem. Examples of line integrals of vector fields applications to engineering calculus. Determining of differential operators of scalar functions and vector fields. Applications of Gauss's theorem and Stoke's theorem. Applications of surface integrals of vector fields in geometry and engineering. | 3 |
| Cl 5 | Test. | 1 |
| | Total hours: | **11** |

## TEACHING TOOLS USED

N1. Lecture - traditional method or using multimedia tools.
N2. Classes – traditional method (problems sessions and discussion).
N3. Student's own work - preparation for exercises.
N4. Tutorial.

## EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

| **Evaluation**<br>*F – forming (during semester)*<br>*P – concluding (at semester end)* | **Educational effect number** | **Way of evaluating educational effect achievement** |
|---|---|---|
| F1(W) | PEU_W01<br>PEU_W02 | test |
| P(W) | P=F1 | |
| F1(C) | PEU_U01<br>PEU_U02<br>PEU_K01 | oral answers, quizzes, tests |
| P(C) | P=F1 | |

## PRIMARY AND SECONDARY LITERATURE

**PRIMARY LITERATURE:**


[1] W. Żakowski, W. Kołodziej, Matematyka, Cz. II, WNT, Warszawa 2003.
[2] T. Trajdos, Matematyka, Cz. III, WNT, Warszawa 2005.
[3] M. Gewert, Z. Skoczylas, Elementy analizy wektorowej. Teoria, przykłady, zadania, Oficyna Lecdawnicza GiS, Wrocław 2004.


**SECONDARY LITERATURE:**


[1] G. M. Fichtenholz, Rachunek różniczkowy i całkowy, T. III, PWN, Warszawa 2007.
[2] W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, Cz. II, PWN, Warszawa 2006.
[3] F. Leja, Rachunek różniczkowy i całkowy ze wstępem do równań różniczkowych, PWN, Warszawa 2008.
[4] B. K. Pszczelin, Analiza wektorowa dla inżynierów, PWN, Warszawa 1971.


## SUBJECT SUPERVISOR


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