SYLLABUS

Name: ***Calculus and differential equations (Math 2) (AESAu-A>SI1CDE24)***
Name in Polish:
Name in English: ***Calculus and differential equations (Math 2)***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

EGZ

Language:

English

Short description:

This course aims to enable students to master single-variable and multivariable calculus, analytic geometry in space, and differential equations.

Description:

ECTS:6
Total workload: 150 (75 contact hours / 75 student's own work hours)
Lecture:30h
Exercise: 30h
Other (test's revision): 15h
Student's own work: preparation for classes, writing reports, preparation for tests and exercises

Lecture
1. Functions and limits:
1.1. Limit definition and properties of sequence and function.
1.2. Infinitesimal and infinity, limit algorithm.
1.3. The limit existence criterion, two important constraints.
1.4. Comparison of infinitesimal.
1.5. Continuity and discontinuity of function. Operation of continuous function and continuity of elementary function. Properties of continuous function on closed interval.
2. Derivatives and differentials:
2.1. Concept of derivative. Derivation rule of function. Higher derivative.
2.2. The relative rate of change of derivative of implicit function and function determined by parametric equation.
2.3. The differential of the function.
3. The mean value theorem of differential and the application of derivatives
3.1. Mean value theorem of differentiation.
3.2. L 'Hopital's rule.
3.3. Taylor's formula.
3.4. Monotonicity of function and concavity of curve. The extreme value and maximum value of the function.
3.5. Description of function graph. Curvature.
4. Indefinite integral:
4.1. The concept and properties of indefinite integral. Substitution integral method.
4.2. Integration by parts. Integral of rational function. Use of points table.
5. Definite integral:
5.1. The concept and properties of definite integral. Basic formula of calculus.
5.2. Definite integral substitution method and integration by parts. Improper integral.
6. Application of definite integrals
6.1. Element method of definite integral.
6.2. The application of definite integral in geometry and physics.
7. The differential equation
7.1. Basic concepts of differential equations. Separable differential equations. Homogeneous equation.
7.2. First-order linear differential equations.
7.3. Higher order linear differential equations.
7.4. Homogeneous and nonhomogeneous linear differential equations with constant coefficients.
8. Spatial analytic geometry and vector algebra
8.1. Vector and its linear operation. Dot product vector product mixed product.
8.2. Surface, space, plane equations.
8.3. Spatial straight lines and their equations.
9. Differential method of multivariate function and its application
9.1. The basic concept of multivariate function. Partial derivative. Total differentiation.
9.2. Derivation rules of multivariate composite functions. Derivation formula of implicit function.
9.3. Geometric applications of differential calculus of multivariate functions.
9.4. Directional derivative and gradient.
9.5. Extreme value of multivariate function and its method.
10. Double integral
10.1. The concept, properties and calculation method of double and triple integral.
10.2. The application of multiple integration.
11. Curve integral and surface integral
11.1. Curve integral of arc length. Surface integral over area.
11.2. The integral of the coordinate surface. Flux and divergence of Gaussian formula. Stokes formula ring flow and curl.
12. Infinite series
12.1. The concept and properties of series of constant terms. Convergence method.
12.2. Function expansion into power series. The application of power series expansion.

12.3. Fourier series of general periodic functions.

Bibliography:

1. Edmund Landau, Differential and Integral Calculus, American Mathematical Society
2. Preston Albert Lambert, Differential and Integral Calculus For Technical Schools and Colleges, MJP Publishers

Learning outcomes:

Students are expected to obtain the following mathematical knowledge and abilities through the theoretical teaching of this course:
1. Knows the basic concepts and theories of differential calculus and integral calculus of one variable function, including limit, derivative and differential, original function, indefinite integral and definite integral concepts as well as related properties, theorems and basic integral formulas (K1A_W1).
2. Knows the limit, derivative and differential calculation method, differential mean value theorem and its application, method of variable upper limit of integral derivative, indefinite integral and definite integral element of the definite integral calculation method, moreover, its application in geometry and physics (K1A_W1).
5. Master the basic calculation methods of differential equations, spatial analytic geometry and multivariate differential calculus, cultivate mathematical reasoning ability, spatial imagination ability and operation ability of rigorous logic. Furthermore, students are expected to apply the knowledge of differential equations, spatial analytic geometry, multivariate differential calculus, multiple integration, line and surface integration and infinite series comprehensively to mathematical calculation, problem solving, theoretical derivation and complex engineering problem solving (K1A_W7).
6. Is able to abstract thinking, logical reasoning, imaginary in space and self-study for student will be trained during the process of studying. Perform time and frequency analysis. Moreover, this course will pay special attention to the ability of students' operation and the capacity of using mathematics knowledge to solve practical problems (K1A_U1, K1A_U12).

Assessment methods and assessment criteria:

The condition for completing the course is passing all the tests during the exercises and passing the exam.

Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	6	2024/2025-Z	