RTU Course "Supplementary Mathematics (for electrical engineering)"

12501 Inženiermatemātikas katedra

General data

Code	DIM205
Course title	Supplementary Mathematics (for electrical engineering)
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Mathematics and Statistics
Responsible instructor	Marija Iltiņa
Academic staff	Vladislavs Kremeņeckis Irīna Eglīte Vera Gošteine Ilmārs Iltiņš Jeļena Liģere Marija Dobkeviča Sergejs Smirnovs Māra Birze Vaira Buža
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Abstract	Line integrals and surface integrals. Scalar and vector fields. Derivative in the direction, gradient, flux, circulation, divergence, rotor, Gauss' and Stokes' theorems. Laplace operator in curvilinear coordinates. Function of complex variable. Cauchy's theorem and integral formula. Taylor and Laurent series. Residues. Laplace transform, its basic properties and applications. Bessel functions.
Goals and objectives of the course in terms of competences and skills	To enable students to acquire basic knowledge of the theory of functions of complex variable, the theory of integral transforms and the field theory necessary for he successful acquisition of specialized courses. To develop student's argumentative reasoning and the ability to use the newly learned concepts in practice.
Structure and tasks of independent studies	Within the framework of the study course, a student has to accomplish 3 home assignments on the following themes: the theory of functions of a complex variable, Laplace transform, field theory. Assignments are to be submitted to an instructor at the given time and they can be corrected only once. Student is allowed to take the examination if all home assignments are submitted and the positive assessment is received.
Recommended literature	1. Antimirovs M., Panfjorova A., Volodko I. Vairākkārtīgie integrāļi un lauku teorija. Rīga, RTU, 1998, 226 lpp. 2. Antimirovs M., Panfjorova A., Liepiņa V. Kompleksā mainīgā funkcijas un konformie attēlojumi. Rīga, RTU, 1990, 81 lpp 3. Kronbergs E., Rivža P., Bože Dz. Augstākā matemātika. 2. daļa, Rīga, Zvaigzne, 1988, 527 lpp.
Course prerequisites	DIM101, Mathematics

Course outline

Theme	Hours
Line integrals of the first and second type.	4
Function of a complex variable. Continuity, limit, derivative. Cauchy-Riemann conditions.	4
Cauchy' s theorem. Integral. Series. Taylor and Laurent series.	4
Residue. Application of residues for calculation of integrals.	4
Laplace transform. Inverse transform. Application of Laplace transform to the solution of differential equations.	4
Surface integrals of the first and second kind.	4
Scalar field. Directional derivative. Gradient. Vector field. Flux and divergence of a vector field.	4
Circulation of a vector field. Stokes' formula.Curl of a vector field. Potential, divergence-free and curl-free fields.	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
After successful completion of the study course a student is able to calculate line integrals of the first and second type, to apply the Green's formula.	Evaluation of students' knowledge and skills is based on the results of homework assignments and final examination.
Able to calculate the value of complex variable function, to check Cauchy-Riemann conditions, to find an analytical function by either its real or imaginary part.	Evaluation of students' knowledge and skills is based on the results of homework assignments and final examination.
Able to calculate an integral of complex variable function, to apply Cauchy's theorem, to expand a function in Taylor and Laurent series.	Evaluation of students' knowledge and skills is based on the results of homework assignments and final examination.

Able to calculate a residue and integrals with the aid of residues.	Evaluation of students' knowledge and skills is based on the results of homework assignments and final examination.
Able to find a Laplace transform of a function and an inverse transform, to solve differential equations using Laplace transform.	Evaluation of students' knowledge and skills is based on the results of homework assignments and final examination.
Able to calculate surface integrals of the first and second kind.	Evaluation of students' knowledge and skills is based on the results of homework assignments and final examination.
Able to calculate a directional derivative and a gradient of a scalar field, to calculate flux and divergence of a vector field, to apply the Gauss-Ostrogradsky formula.	Evaluation of students' knowledge and skills is based on the results of homework assignments and final examination.
Able to calculate the circulation and curl of a vector field, to apply Stokes' formula, to calculate the potential of a field.	Evaluation of students' knowledge and skills is based on the results of homework assignments and final examination.

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	2.0	3.0	1.0	1.0	0.0		*	