RTU Course "Supplementary Mathematics (for mechanical engineering)"

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General data

Code	DIM208
Course title	Supplementary Mathematics (for mechanical engineering)
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Ilona Dzenīte
Academic staff	Andrejs Koliškins Sergejs Smirnovs Tamāra Kabiša Māra Birze Inta Volodko Evija Kopeika Vera Gošteine Jeļena Liģere
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN
Annotation	The study course contains mathematics sections, which are necessary for the student to understand and successfully master the study courses of the specialty. The study course covers basic questions on the following mathematics topics: Fourier series. Line integrals and surface integrals. Elements of the theory of functions of a complex variable (Complex numbers, functions of a complex variable, derivative and integral of a function of a complex variable. Cauchy's theorems and integral formula). Elements of field theory (Scalar and vector field. Directional derivative, gradient, divergence and curl. Vector field flux, work and circulation. Gauss' and Stokes' formulas). Operator calculus (Laplace transform, its basic properties and applications). The examples used in the study course illustrate the application of the considered concepts and methods in the fields related to the specialty.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to enable students to acquire basic knowledge of mathematical concepts necessary for the understanding of processes and algorithms in professional subjects. The tasks of the study course are to develop students' logical thinking and skills to be able to analyse more complicated problems related to study courses of professional specialization.
Structure and tasks of independent studies	There are two mandatory individual homework assignments on the following themes: Fourier series and Laplace transform; and two assessment tests on the following themes: Elements of complex variable theory and Elements of field theory. In order to get the permission to take the exam, students must receive a positive evaluation of their individual homework assignments and assessment tests.
Recommended literature	Obligātā: 1. K.Šteiners. Augstākā matemātika. Lekciju konspekts inženierzinātņu un dabaszinātņu studentiem. 5. daļa, Zvaigzne, 2000, 130 lpp., un 6. daļa, Zvaigzne, 2001, 208 lpp. 2. Antimirovs M., Panfjorova A., Volodko I. Vairākkārtīgie integrāļi un lauku teorija. Rīga, RTU, 1998, 226 lpp. 3. T. Kabiša, V. Gošteina. Matemātikas papildnodaļas. Metodiskais līdzeklis. Rīga, RTU Inženiermatematikas katedra, 2009, 144 lpp. 4. Inta Volodko. Augstākā matemātika. 2. dala, Rīga, Zvaigzne ABC, 2009, 396 lpp. 5. Antimirovs M., Panfjorova A., Liepiņa V. Kompleksā mainīgā funkcijas un konformie attēlojumi. Rīga, RTU, 1990, 81 lpp. Papildu: 6. N. Orbidāne, Dz. Lūse, I. Volodko. Tipveida uzdevumi matemātikas papildnodaļās transporta un mašīnzinību specialitātēm. Rīga, RTU, 2003, 50 lpp. 7. Kronbergs E., Rivža P., Bože Dz. Augstākā matemātika. 2.d., Rīga, Zvaigzne, 1988, 527 lpp. 8. T. Cīrulis, O. Dzenītis. Kompleksā mainīgā funkciju teorija piemēros. Zvaigzne, 1983. 9. I.Egle, B. Siliņa, A. Strence. Uzdevumu krājums augstākās matemātikas speciālajā kursā. 1976. Citi informācijas avoti: YouTube videos
Course prerequisites	Single variable and multivariable differential calculus. Indefinite and definite integral. Double and triple integral. Numerical and functional series.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Fourier series.	4	4	1	4
Line and surface integrals.	5	7	3	11
Elements of complex variable theory.	8	10	4	15
Elements of field theory.	10	12	5	18
Laplace transform.	5	7	3	12
Consultations.	4	0	2	0
Examination.	4	0	2	0

Total:	40	40	20	60

Learning outcomes and assessment

Learning outcomes	Assessment methods
Able, based on the acquired knowledge of Fourier series, to analyse periodic processes that take place in engineering and physics, for instance, in signal theory.	Evaluation of students' knowledge is based on the results of final examination and homework assignments.
Able to find line integrals and solve related problems on vector field work and circulation, and weight of material line.	Evaluation of students' knowledge is based on the results of final examination and assessment tests.
Able to find surface integrals and solve related problems on vector field flux through different shape surfaces, and weight of material surface.	Evaluation of students' knowledge is based on the results of final examination and assessment tests.
Able to find basic characteristic values of scalar and vector field: directional derivatives, gradient, vector field flux, work, circulation, divergence, rotor, and able to check if the vector field is potential.	Evaluation of students' knowledge is based on the results of final examination and assessment tests.
Able to use the acquired knowledge of elements of complex variable theory to solve problems that arise in theoretical physics, hydromechanics, elasticity theory and radio engineering.	Evaluation of students' knowledge is based on the results of final examination and assessment tests.
Able to use Laplace transforms to solve differential equations and systems of differential equations in electrical engineering and automatic control theory.	Evaluation of students' knowledge is based on the results of final examination and homework assignments.

Evaluation criteria of study results

Criterion	%
Tests	40
Homeworks	10
Examination	50
Total:	100

Study subject structure

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