SVEUČILIŠTE U RIJECI
ODJEL ZA MATEMATIKU

Sveučilište u Rijeci •Odjel za matematiku
Radmile Matejčić 2 • 51 000 Rijeka • Hrvatska
T: (051) 584-650 • F: (051) 584-699
http://www.math.uniri.hr• e-adresa: math@math.uniri.hr

COURSE SYLLABUS

General information		
Course title	**Introduction to Design Theory**	
Study programme	Graduate course Discrete Mathematics and Its Applications	
Year of study	2nd	
Course status	Compulsory	
Course homepage	https://moodle.srce.hr/	
Language of instruction	English	
Credit values and modes of instruction	***ECTS credits / student workload***	*6*
	Hours (L+E+S)	*30 + 15 + 15*
Lecturer	***Name and surname***	*Sanja Rukavina*
	Office	*O-308*
	Office hours	*Upon request*
	Phone number	*584-651*
	E-mail	*sanjar@math.uniri.hr*
Teaching assistant	***Name and surname***	*Tin Zrinski*
	Office	*O-319*
	Office hours	*Thursday, 14:00-15:30*
	Phone number	*584-679*
	E-mail	*tin.zrinski@math.uniri.hr*

1. COURSE DESCRIPTION

1.1. Course objectives

Main course objectives are:
- acquaint students with the basic definitions, concepts, procedures and theorems of the design theory
- indicate the relation between different combinatorial structures, link designs with codes, graphs, differential sets, latin squares
- acquaint students with basic applications of a combinatorial design in the coding theory, to threshold schemes, visual cryptography and group testing.

1.2. Course prerequisites

None.

1.3. Learning outcomes

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After completing this course students should be able to:
- define the basic concepts of the design theory and apply with the argument some basic procedures in the design theory (A7, B7);
- know and prove the basic theorems of the design theory (B7, F4);
- construct examples for block designes and related combinatorial structures (C7, D7, E5, F7, G7);
- apply the design theory in the elementary problems of the coding theory, threshold schemes, visual cryptography and group testing (A7, B7, C7).

1.4. Course content

Basic definitions and properties of combinatorial designes; incidence matrix, isomorfism and automorfism, Fisher's inequality. Symmetric designs; differential sets, construction of differential sets, residual and derived designs, Hadamard matrix and designs, Bruck-Ryser-Chowla theorem. Resolvable designs; affine plane, projective plane, Bose's Inequality, affine design. Steiner triple system; quasigroups, The Bose construction, The Skolem construction, cyclic Steiner triple system. Orthogonal latin squares; mutually orthogonal latin squares, orthogonal array and transversal designs. Applications of combinatoral designs; codes, threshold scheme, visual cryptography, group testing.

1.5. Modes of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☒ e-learning ☐ field work	☒ independent work ☒ multimedia and the internet ☐ laboratory ☒ tutorials ☒ mentoring work ☒ consultative teaching ☐ other
1.6. Comments		

1.7. Student requirements

Students are expected to attend classes and actively participate in them, and to take notes. They are required to achieve a certain number of points during the semester and to pass the final exam. Details on the grading system are explained in the following paragraph, titled Grading policy.

2. GRADING POLICY

2.1. Grading of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester and on the final exam. The total number of points a student can achieve during the semester is 70. To gain access to the final exam, students are required to achieve at least 50% of the points on each conducted evaluation activity during the semester. Moreover, in order to gain access to the final exam, students have to fulfill the minimal requirements described below. The maximum number of points that can be achieved on the final exam is 30, with the passing score being 50% for each part of the exam.. The final exam consists off a short online test an oral exam.

Students who achieve between 0% and 49.9%, through all of the activities evaluated, will receive the grade F (Insufficient), they cannot get the ECTS credits and will have to enroll in the course again. The same is true for students who do not pass the final exam during the examination period.

Midterm exams (30 points total)
During the semester, three exams will be conducted. On each of these exams a student can achieve at most 10 points.

Homework (5 points)
Each student will be assigned a few problems to solve at home. Students can earn at most 5 points for their homeworks in total.

Seminar (20 points)

During the semester students will be assigned topics for which they should prepare and present a seminar paper. The maximum number of points that can be achieved for this activity is 20.

Online tests (15 points)
Three short online tests (15 minutes in duration each) will be organized during the semester. On each of these exams a student can achieve at most 5 points. Online tests will be organized in the same week as midterm exams.

Final exam (30 points)
The final exam consists of online test and an oral exam and the maximum number of points that can be achieved on the test is 30 in total. Passing score is 50% on each part of the test..

2.2. Minimal requirements for access to the final exam / passing grade

ACTIVITY	MINIMAL NUMBER OF POINTS REQUIRED
For each activity students are required to achieve at least 50% of the points.	
TOTAL:	
OTHER REQUIREMENTS:	

2.3. Final grade – grading scale

According to the total number of points achieved during the semester and on the final exam, the final grade is determined using the following scale:

GRADE	POINTS
Excellent (5) , A	90% - 100%
Very good (4), B	75% - 89,9%
Good (3), C	60% - 74,9%
Sufficient (2), D	50% - 59,9%
Insufficient (1), F	0% - 49,9%

3. LITERATURE

3.1. Required literature

1. *D. R. Stinson: Combinatorial Designs with Selected Applications (Lecture Notes), University of Manitoba, Canada, 1996.*
2. *E. F. Assmus, J. D. Key: Designs and their Codes, Cambridge University Press, 1992.*

3.2. Recommended literature

1. *I. Anderson, I. Honkala: A Short Course in Combinatorial Designs, Internet Edition, 1997. (www.utu.fi/~honkala/designs.ps)*
2. *P.J. Cameron, J.H. van Lint: Graphs, Codes and Designs, Cambridge University Press, 1980.*
3. *Y.J.Ionin, M.S. Shrikhande: Combinatorics of Symmetric Designs, Cambridge University Press, 2006.*
4. *D. R. Stinson: Combinatorial Designs with Selected Applications (book), Springer-Verlag New York, 2004.*

4. ADDITIONAL INFORMATION

4.1. Class attendance

Taking midterm exams is mandatory. Class attendance is recommended, though not mandatory. Students are required to inform themselves about all classes that they missed. No disturbance of classes will be tolerated, and the usage of calculators, cell phones or electronic devices of any kind is absolutely forbidden during class.

4.2. Informing students

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All relevant course information will be posted on the course homepage, on **merlin.srce.hr**. It is the student's personal responsibility to be regularly informed, by checking the course web page and their official email.
4.3. Other relevant information
Students are expected to have a high degree of independence and responsibility in their work. During the course, an active aproach to learning will be encouraged. While performing the tasks specified within the course curriculum, students must represent their own work, and they are not allowed to use someone else's text as their own. Submitting work that incorporates someone else's ideas without citation is considered as stealing intellectual property and can be punished according to the university regulations. Students should prepare their work according to the instructions given during the classes.
4.4. Assessment of quality and performance for the course
Quality of the lectures is assessed in accordance with the regulations of Department of Mathematics and the University of Rijeka. At the end of the semester, an anonymous survey will be conducted, in which students will evaluate the quality of the lectures. Additionally, the department will conduct the analysis of the examination results.
4.5. Examination period

Final exam (1st examination period)	June 15, 2021, 10 a.m.
Final exam (2nd examination period)	June 30, 2021, 10 a.m.
Final exam (3rd examination period)	August 30, 2021, 10 a.m.

5. COURSE OUTLINE*

DATE	*TIME*	*MODE OF INSTRUCTION*	*TOPIC*	*GROUP*	*LECTURE HALL*
1.3.2021.	11:15 – 12:45	L	Introduction, Basic Terms		O-334
8.3.2021.	11:15 – 12:45	L	Isomorphisms and Automorphisms. New BIBDs from Old. Fisher's Inequality		O-334
12.3.2021.	13:15 – 14:45	E,/S	Introduction, Basic Instructions in GAP		O-334
15.3.2021.	11:15 – 12:45	L	Symmetric BIBDs, Residual and Derived BIBDs, *Bruck-Ryser-Chowla*		O-334
19.3.2021.	13:15 – 14:45	E	Symmetric BIBDs, Residual and Derived BIBDs		O-334
22.3.2021.	11:15 – 12:45	L	Difference Sets, Some Constructions of Difference Sets		O-334
26.3.2021.	13:15 – 14:45	S	Presentation of seminar papers		O-334
29.3.2021.	11:15 – 12:45	L	Hadamard Matrices and Designs		O-360
2.4.2021.	13:15 – 14:45	S	Difference Sets, Some Constructions of Difference Sets		O-334
5.4.2021	11:15 – 12:45	L	Conference Matrices		O-334
9.4.2021	13:15 – 14:45	E	Online Test and Midterm Exam		O-334
12.4.2021	11:15 – 12:45	L	Resolvable BIBDs, Affine Planes		O-334

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16.4.2021	13:15 – 14:45		Presentation of seminar papers		O-334
19.4.2021	11:15 – 12:45	L	Bose's Inequality and Affine Resolvable BIBDs		O-334
23.4.2021	13:15 – 14:45	E	Hadamard Matrices and Designs, Conference Matrices		O-334
26.4.2021	11:15 – 12:45	L	Steiner Triple Systems, Quasigroups, Latin Squares		O-334
30.4.2021	13:15 – 14:45	E	Resolvable BIBDs, Affine Planes, Projective Planes		O-334
3.5.2021.	11:15 – 12:45	L	The Bose Construction, The Skolem Construction		O-334
7.5.2021.	13:15 – 14:45	S	Online Test and Midterm Exam		O-334
10.5.2021.	11:15 – 12:45	L	Cyclic Steiner Triple Systems		O-334
14.5.2021.	13:15 – 14:45	S	Presentation of seminar papers		O-334
17.5.2021.	11:15 – 12:45	L	Orthogonal Latin Squares		O-334
21.5.2021.	13:15 – 14:45	E	Steiner Triple Systems, Quasigroups, Latin Squares		O-334
24.5.2021.	11:15 – 12:45	S	Mutually Orthogonal Latin Squares		O-334
28.5.2021.	13:15 – 14:45	E	The Bose Construction, The Skolem Construction, Cyclic Steiner Triple Systems		O-334
31.5.2021.	11:15 – 12:45	L	Orthogonal Arrays and Transversal Designs		O-334
4.6.2021.	13:15 – 14:45	E	Orthogonal Latin Squares, Mutually Orthogonal Latin Squares, Orthogonal Arrays and Transversal Designs		O-334
7.6.2021.	11:15 – 12:45		Online Test and Midterm Exam		O-334
11.6.2021.	13:15 – 14:45		Remedial activities		O-334

**Minor changes are possible. Up to 40% of lectures can be held online.*

L – lectures
E – exercises
S – seminars