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| **1. Course title:** Theory of Representations | | | | |
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| **2. Code:** | | **3. Type (lecture, practice etc.):** discussion | | |
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| **4. Contact hours: 2** hoursper week | | **5. Number of credits (ECTS):** 2 | | |
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| **6. Preliminary conditions (max. 3):**  Abstract Algebra lecture and seminar | | | | |
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| **7. Announced:** ☐fall semester, ☒spring semester, ☐both | | | | |
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| **8. Limit for participants:** 40 | | | | |
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| **10. Responsible teacher (faculty, institute and department):**  Alice Fialowski PhD, DSC, dr. Habil (Faculty of Science, Institute of Mathematics and Informatics, Department of Mathematics) | | | | |
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| **11. Teacher(s) and percentage:** | | Alice Fialowski PhD, DSC, dr.Habil | | 100 % |
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| **12. Language:** English | | | | |
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| **13. Course objectives and/or learning outcomes:** Basics of linear representations of groups, examples.  **Objectives:**  **Learning outcomes:**. | | | | |
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| **14. Course outline**   1. Group representations, examples. Sub-representations, factor-representation. Direct sum. Irreducible and indecomposable representations. 2. Homomorphism of representations (intertwining operators), isomorphism of representations. Schur-lemma. 3. Maschke Theorem on complete reducibility of representations of a finite group. Examples of reducible bu not indecomposable representations of infinite and positive characteristic groups. 4. Unicity of decomposition to irreducible representations. Multiplicity of irreducible sub-representations. 5. Intertwining operators of regular representations, decomposition of regular representation. Burnside formula and its analogue for arbitrary fields. 6. Examples: representations of a commutative group, dihedral group, . 7. Midterm 1 8. Orthogonality of the matrix elements of irreducible representations, orthogonality of characters. Condition involving characters for irreducibility of a representation, and isomorphism of two representations. 9. Completeness property of characters in the space of center functions of a group. Number of irreducible representations and conjugacy classes up to isomorphism. 10. Definition of representation of a ring and algebra. Group ring, group algebra. Connection of representations with the group representations. 11. Structure of the group algebra over an algebraically closed field. Connection with regular representations. 12. Representations of the symmetric group. Young diagram, connection with the conjugacy classes of the symmetric group. 13. Midterm 2. | | | | |
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| **15. Mid-semester works**  2 midterms | | | | |
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| **16. Course requirements and grading**  2 midterms + active participation in the discussion sessions. | | | | |
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| **17. List of readings**   1. E.B. Vinberg: Linear Representations of Groups. Springer 2010. 2. B. Steinberg: Representation Theory of Finite groups. Carleton University, 2009. | | | | |
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| **18. Recommended texts, further readings**  . | | | | |
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| **Date** | 10 May, 2017 | **Prepared by** | Alice Fialowski PhD, DSC, dr. Habil, responsible teacher | |
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| **Endorsed by** | | | László Tóth, PhD, Dr. Habil program supervisor | |