Course title: Graph Theory

Teacher: Bojana D. Borovićanin

Course Status: elective

ECTS value: 12

Requirement:

Course Goals and Objectives: Introduction to the concepts and theorems of graph theory, as well as some possibilities of its application. Enabling students to formulate and solve numerous problems in this field using graph theory techniques and methods.

Course Outcome: The student has acquired the theoretical knowledge necessary to understand the problems in graph theory, including possible applications in mathematics, computer science, electrical engineering, natural sciences, and other fields. The student has mastered the skills and methods of research in this area.

Course Content

Theory

Basic concepts of graph theory. Graph invariants. Graph operations. Planar graphs and polyhedron graphs. Euler's theorem, Kuratowski–Pontryagin theorem. Graph colouring. Chromatic number of graphs. Euler and Hamilton paths and contours. Independent sets, covers, and graph cliques. Internal and external stability of graphs with application in code theory. Menger's theorem and transport networks. Matrices in graph theory. Linear algebra and graphs. Groups and graphs. Extreme graphs. General method of defining different types of graph spectra. Coefficients of different characteristic polynomials of a graph. Graph operations and resulting spectra. Relationships between spectral and structural properties of digraphs and graphs. Graph eigenvectors. Characterization of graphs by spectra. Spectral techniques in graph theory. Application in computing, chemistry, and physics.

Practice

Recommended Sources

1. L. Beineke, R. Wilson, P. Cameron, *Topics in Algebraic Graph Theory*, Cambridge University Press, Cambridge, 2004.
2. B. Bollobas, *Modern Graph Theory*, Series: Graduate Texts in Mathematics, Vol. 184, Springer, New York, 1998.
3. D. Cvetković, *Teorija grafova i njene primene*, Naučna knjiga, Beograd, 1981.
4. D. Cvetković, M. Doob, H. Sachs, *Spectra of Graphs*, 3rd edition, Johann Ambrosius Barth Verlag, Heidelberg–Leipzig, 1995.
5. R. Diestel, *Graph Theory*, Series: Graduate Texts in Mathematics, Vol. 173, Springer, Berlin, Heidelberg, 2017.
6. V. Petrović, *Teorija grafova*, Univerzitet u Novom Sadu, 1998.
7. D. West, *Introduction to Graph Theory*, Second Edition, Prentice Hall, 2001.

Active teaching hours: 5	Theory: 5	Practise:

Applicable Teaching Methods

Lectures, homework, seminar papers, consultations

Grading Scheme (max. 100 points)

in-class activity (homework) 10 points, seminar papers 30 points, final exam (oral exam) 60 points