האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

polytopes - 80679

Last update 18-09-2024

HU Credits: *2*

Degree/Cycle: *2nd degree (Master)*

Responsible Department: *Mathematics*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *English*

Campus: *E. Safra*

Course/Module Coordinator: *Eran Nevo*

Coordinator Email: *nevo@math.huji.ac.il*

Coordinator Office Hours:

Teaching Staff:

Prof. Eran Nevo

Course/Module description:

Polytopes have fascinated humans since antiquity and are related to many areas of modern mathematics. We will study polytopes, focusing on connections between their geometric and combinatorial properties.

Course/Module aims:

Learning outcomes - On successful completion of this module, students should be able to:

Deduce combinatorial properties of polytopes from their geometry and convexity. To give a lecture to peers.

Attendance requirements(%):

Teaching arrangement and method of instruction:

Course/Module Content:

1. Faces of polytopes:
the face lattice, polarity, simple and simplicial
polytopes, projective transformations.
basic constructions (e.g. product, join, cyclic polytope, Gale's evenness condition).
2. Graphs of polytopes:
Tell a simple polytope from its graph –
Kalai's proof, Balinski's theorem, refinement theorems, the Hirsch conjecture on diameter and Santos' counterexample.
3. Schlegel diagrams.
4. Gale duality.
5. f-vectors of simplicial polytopes: Dehn-Sommerville relations, McMullen's upper bound theorem and shellability; Barnette's lower bound theorem and rigidity; the g-theorem.
6. Fiber polytopes: the associahedron and the permutohedron.
7. Realization spaces of polytopes.
8. Subfamilies: centrally symmetric polytopes, cubical polytopes, balanced polytopes.

Required Reading:

G¨unter Ziegler, Lectures on Polytopes

Additional Reading Material:

Branko Gr¨unbaum, Convex Polytopes

Igor pak, Lectures on Discrete and Polyhedral Geometry

Grading Scheme:

Presentation / Poster Presentation / Lecture 80 %

Attendance / Participation in Field Excursion 20 %

Additional information: