Term Information

Effective Term	Spring 2023

General Information

Course Bulletin Listing/Subject Area	Mathematics
Fiscal Unit/Academic Org	Mathematics - D0671
College/Academic Group	Arts and Sciences
Level/Career	Graduate
Course Number/Catalog	7821.02
Course Title	Geometric Group Theory
Transcript Abbreviation	Geom Group Theory
Course Description	Caley graphs, Quasi-isometries, Fundamental Lemma of GGT, Bass-Serre theory, Free groups, amalgams, surface groups, Universal covers, Hyperbolic space, Nonpositive curvature and CAT(0) geometry, Hyperbolic groups, Simple complexes of groups, Coxeter groups, Artin groups, Graph products of groups, Actions on CAT(0) cube complexes. Examples of group actions on contractible polyhedra.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Satisfactory/Unsatisfactory
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Post-candidacy status in Mathematics Graduate Program and permission of instructor
Exclusions	Not open to students with credit for 7821.01
Electronically Enforced	Yes

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	27.0101
Subsidy Level	Doctoral Course
Intended Rank	Doctoral

Requirement/Elective Designation

Survey Course

Course Details

Course goals or learning objectives/outcomes

- Acquire basic concepts and skills in Geometric Group Theory in preparation for research in this and related areas.

Content Topic List

- Cayley graphs, quasi-isometries and fundamental lemma of GGT.
- Bass-Serre theory: actions on trees, graph of spaces/groups, amalgamations and HNN extensions.
- Higher-dimensional generalizations of Bass-Serre theory: complex of groups, wall-spaces and cubulation.
- Curvature of metric spaces/groups: Gromov-hyperbolicity, quasi-geodesic combings and semi-hyperbolicity, CAT(0) spaces.
- Specific examples of groups/spaces: Coxeter groups, Artin groups, Bestvina-Brady groups, Thompson groups, graph products and right-angled buildings, Tits buildings, Davis buildings.
- Special cube complexes: canonical completion and retraction, residual properties of groups

Sought Concurrence

No

Attachments

- MATH7821.02_GGT_SyllabusNew.pdf: Math 7821.02 Sample Syllabus

(Syllabus. Owner: Kerler,Thomas)

Comments

- Mathematics splits each of its 7000-level courses into a .01 and .02 section, to be taught by the same instructor in the same class, but different expectations.
  .01-sections are for pre-candidacy students and non-math graduate students. They are letter graded, and require standard homework/exam assignments.
  .02-sections are for math post-candidacy students only. They are S/U graded and generally require the completion of a project or presentation determined by the instructor.
  This allows out post-candidacy students to receive supplementary training without diverting too much time from their dissertations. *(by Kerler,Thomas on 04/22/2022 08:12 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kerler,Thomas	04/22/2022 08:25 PM	Submitted for Approval
Approved	Husen,William J	04/23/2022 08:36 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	05/02/2022 11:54 AM	College Approval
Pending Approval	Cody,Emily Kathryn Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	05/02/2022 11:54 AM	ASCCAO Approval

Math 7821.02 Syllabus **Spring 2023**

Geometric Group Theory

Instructor and Class Information

Lecturer:	**Course Num.:**
Office:	**Lecture Room:**
Phone:	**Lecture Times:**
Email:	**Office Hours:**

Course Information

Course Goals

Students will acquire knowledge on the basics of geometric group theory, as well as have a sense of several topics in the frontier of this subject. This will enable them to conduct research in geometric group theory and related area.

Course Description

The course will begin with the introduction or review of topological concepts such as Caley graphs, Quasi-isometries, Fundamental Lemma of GGT, Bass-Serre theory, free groups, amalgams, surface groups, and universal covers. This is followed by geometric notions such as hyperbolic space and nonpositive curvature and CAT(0) geometries. Topics related to groups and group actions are hyperbolic groups, Simple complexes of groups, Coxeter groups, Artin groups, graph products of groups, and actions on CAT(0) cube complexes. Examples of group actions on contractible polyhedra will be emphasized.

Format

The course will meet three times a week for 55 minutes each meeting.

Prerequisites

Mathematics post-candidacy status and permission of instructor.

Textbooks

Main References (required)

M. Bridson and A. Haefliger, *Metric spaces of non-positive curvature*, Springer 1999. ISBN 3-540-64324-9

Supplementary texts (Recommended)

M.W. Davis, *The geometry and topology of Coxeter groups*, Princeton Univ. Press, 2008. ISBN-10: 0-691-13138-4

C. Druţu and M. Kapovich, Geometric group theory. With an appendix by Bogdan Nica. American Mathematical Society Colloquium Publications, 63. American Mathematical Society, Providence, RI, 2018. xx+819 pp. ISBN: 978-1-4704-1104-6

M. Gromov, *Hyperbolic Groups*, in *Essays in group theory,* MSRI publications, vol 8, Springer, 1987.

Assessments

PROJECT

A "satisfactory" grade will be based entirely on the successful completion of a course project assigned individually by the instructor. The project entails a short presentation in a setting to be determined by the instructor.

Content Topic Lists

1. Cayley graphs, quasi-isometries and fundamental lemma of GGT;
2. Bass-Serre theory: actions on trees, graph of spaces/groups, amalgamations and HNN extensions.
3. Higher-dimensional generalizations of Bass-Serre theory: complex of groups, wall-spaces and cubulation.
4. Curvature of metric spaces/groups: Gromov-hyperbolicity, quasi-geodesic combings and semi-hyperbolicity, CAT(0) spaces.
5. Specific examples of groups/spaces: Coxeter groups, Artin groups, Bestvina-Brady groups, Thompson groups, graph products and right-angled buildings, Tits buildings, Davis buildings.
6. Special cube complexes: canonical completion and retraction, residual properties of groups

Weekly Schedule

Week 1	Cayley graphs
Week 2	Quasi-isometries, Fundamental Lemma of GGT
Week 3	Actions on trees (Serre theory)
Week 4	Free groups, amalgams, surface groups
Week 5	Universal covers
Week 6	Hyperbolic space, Nonpositive curvature
Week 7	Hyperbolic groups
Week 8	Simple complexes of groups
Week 9	Coxeter groups, Artin groups
Week 10	Graph products of groups
Week 11	Bestvina-Brady groups
Week 12	Actions on CAT(0) cube complexes
Week 13	Right-angled Coxeter groups, Artin groups and buildings
Week 14	Special cube complexes and embeddings into right-angled Artin groups

General Policies

ACADEMIC MISCONDUCT

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand

the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute Academic Misconduct.

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: Any activity that tends to compromise the academic integrity of the University, or subvert the educational process. Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an excuse for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

DISABILITY SERVICES

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process (slds.osu.edu/covid-19-info/covid-related-accommodation-requests/), managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.