LEHMAN COLLEGE
OF THE
CITY UNIVERSITY OF NEW YORK

DEPARTMENT OF MATHEMATICS

CURRICULUM CHANGE

1. **Type of change:** New Course

2.

Department(s)	Mathematics
Career	[ ] Undergraduate [X] Graduate
Academic Level	[X] Regular [ ] Compensatory [ ] Developmental [ ] Remedial
Subject Area	Mathematics
Course Prefix & Number	MAT 644
Course Title	Linear and Semidefinite Programming
Description	Systems of linear inequalities, linear matrix inequalities, semidefinite programming. Convex sets in Euclidean n-space, spectrahedra, and spectrahedral shadows. Technology will be used to solve optimization problems.
Pre/ Co Requisites	A course in linear algebra.
Credits	4
Hours	4
Liberal Arts	[X] Yes [ ] No
Course Attribute (e.g. Writing Intensive, WAC, etc)	NA
General Education Component	_X__ Not Applicable ____ Required ____ English Composition ____ Mathematics ____ Science ____ Flexible ____ World Cultures ____ US Experience in its Diversity ____ Creative Expression ____ Individual and Society ____ Scientific World

3. **Rationale:** The Math Department is expanding its applied course offerings to provide students with a better understanding of what foundational courses in Pure Mathematics (such as linear algebra) can be used for. This new course offering provides graduate students with an opportunity to apply theoretical math content while also exploring foundational ideas in linear and semidefinite programming. Additionally, the course incorporates modern techniques from convex algebraic geometry and includes technology to assist students in solving applied problems in optimization.

4. **Learning Outcomes (By the end of the course students will be expected to):**
   1. Classify simple convex semialgebraic sets in Euclidean space into polyhedra, spectrahedra, and spectrahedral shadows
   2. Model applied optimization problems using linear and semidefinite programs
   3. Solve linear and semidefinite programs using interior point methods (with the aid of a computer when the complexity of the problem requires it)

5. **Date of Departmental Approval:** March 3, 2022

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Department(s)	Mathematics
Career	[ ] Undergraduate [X] Graduate
Academic Level	[X] Regular [ ] Compensatory [ ] Developmental [ ] Remedial
Subject Area	Mathematics
Course Prefix & Number	MAT 744
Course Title	Geometric Design and Optimization
Description	Applications of linear programing and semidefinite programming. Use of computer software to design, prototype, print, and test 3D models.
Pre/ Co Requisites	MAT 644
Credits	4
Hours	4
Liberal Arts	[X] Yes [ ] No
Course Attribute (e.g. Writing Intensive, WAC, etc)	NA
General Education Component	_X__ Not Applicable ____ Required ____ English Composition ____ Mathematics ____ Science ____ Flexible ____ World Cultures ____ US Experience in its Diversity ____ Creative Expression ____ Individual and Society ____ Scientific World

3. **Rationale:**

The Math Department wishes to incorporate 3D printing technology and experiential learning to enhance instruction, following ample pedagogical evidence of the benefits of these techniques. Visualization and spatial reasoning contribute fundamentally to the learning process, especially in Mathematics. Working in groups on specific geometric design and optimization problems, students will learn how to combine their mathematical knowledge of optimization techniques and computer programming skills to solve simple versions of real-world manufacturing problems. Finally, experience with 3D printing is an increasingly desirable skill for job applicants in several industries.

4. **Learning Outcomes (By the end of the course students will be expected to):**
   1. Solve basic problems of geometric optimization and design using mathematical tools from Convex Algebraic Geometry and computer software
   2. Manufacture simple 3D models using fused filament fabrication 3D printers
   3. Solve simple real-life optimization and manufacturing problems with 3D printing
   4. Test printed 3D models to develop improved versions closer to optimal solutions
   5. Complete projects in small groups to better understand and appreciate course content.

5. **Date of Departmental Approval:** March 3, 2022