

Course Outline for MATH 4461, Senior Project I

MATH 4461 Senior Project I (2 units)

Prerequisite: Senior standing.

Selection and development of a capstone mathematics project under direct faculty supervision.
Formerly MATH 461.

Course Learning Objectives	
1	Conduct appropriate literature reviews of peer-reviewed publications related to mathematical topics of interest.
2	Synthesize published literature on mathematical topics to place research questions in context, identify unanswered questions, and/or develop useful investigative approaches.
3	Clearly and concisely state researchable questions and/or reductions of general problems to a specific point of analysis.
4	Explore open-ended problems in mathematics.
5	Use standard modes of mathematical investigation such as rigorous logical arguments with proofs and/or numerical computations and simulations.
6	Design and implement key organizational components of independent research such as project proposals and timelines.

Expanded Course Content

Textbooks, materials, and/or other resources
Journals and textbooks relevant to the chosen project topic

Week	Readings	Topics of Discussion
1-2	Literature related to project topic	Literature search Explore possible research questions
3-5	Literature related to project topic	Choose among possible research questions Draft project proposal Ongoing research contributing to project topic

Week	Readings	Topics of Discussion
6	Literature related to project topic	Final proposal and timeline. Ongoing research contributing to project topic
7-14	Literature related to project topic	Ongoing research contributing to project topic
15	Literature related to project topic	Ongoing research contributing to project topic Prepare mid-project report

Content and Method of Assessment

The student should work with the senior project coordinator to identify a project and advisor, then collaborate with the advisor to define a project with a scope requiring approximately 120 hours to complete.

If a student wishes to work with an advisor outside the Department of Mathematics, they must first obtain approval from the MATH 4461/4462 course coordinator and department chair. Note that not all departments will permit such arrangements.

Selection of a topic and a senior project advisor must be made before the last day to add courses for the semester enrolled so that the student can enroll in the specific section of MATH 4461 assigned to the advisor.

The student should meet regularly with their advisor.

The student should work with the advisor to develop a senior project contract representing the planned work and submit it to the senior project coordinator by the end of the fifth week of MATH 4461. The contract must be signed by the senior project advisor, and the student must include a project proposal (see attachment), schedule, and plan for completion.

The advisor will assign a grade in MATH 4461 based on the completion of a significant portion of the senior project, as determined by the advisor.

(Student's name is to appear here, typed)

PROJECT PROPOSAL

Math 461, 462

My proposed research project is in the area of differential geometry. In particular, I will focus on the Gauss and Codazzi-Mainardi equations, the Fundamental Theorem of Surfaces, and the theory of isometric immersions of low-dimensional manifolds. I will use the coordinate approach to differential geometry, allowing for a different perspective from Math 404. The project will culminate with the understanding of an older research paper and work towards a new proof on the classification of isometric immersions of the Euclidean plane into hyperbolic 3-space.

Winter Quarter:

Week 1: Logistics.

Week 2-6: Read past senior project on the coordinate approach to differential geometry, geodesics, and introduction to the Fundamental Theorem of Surfaces.

Week 7-10: Work to understand the Fundamental Theorem of Surfaces. Immerse the plane into $\mathbf{R}^3$ with restrictions from the Gauss' and Codazzi-Mainardi equations. Understand and present the Gauss-Bonnet Theorem for the differential geometry seminar. Begin reading the research paper by Volkov and Vladimirova.

Spring Quarter:

Week 1-3: Introduction to hyperbolic space and the geometry of horospheres.

Week 4-6: Read and understand the research paper by Volkov and Vladimirova.

Week 7-9: Work towards new proof of result using an alternate perspective.

Week 9-10: Finalize summary paper for the senior project.

Student

Senior Project Advisor

Mathematics Department Chair

Date: _____