

Math 10270 : Mathematics in Architecture

CLASS: MWF 12:50–1:40 in HAGGAR 117.

TEXTBOOK: A. Hahn, *Mathematical Excursions to the World's Great Buildings*, Princeton, 2012.

WEBSITE: <https://www3.nd.edu/~rhind/math10270/>

INSTRUCTOR: Richard Hind, hind.1@nd.edu

OFFICE HOURS: MW 1:50–3, HAYES 216, or by appointment.

TEACHING ASSISTANTS: Leighton Douglass, ldougla3@nd.edu, Samantha Monahan, smonaha1@nd.edu

OFFICE HOURS: Tues 2–4, Thurs 3–5, Walsh Family Hall Library.

DESCRIPTION: We will talk about the mathematical aspects of significant architectural developments and famous buildings, starting with the Greeks and moving forward through time. Sometimes geometry was used consciously in a building's design; we will study the relevant geometry based on works of Greek and Renaissance mathematicians. On the other hand historical architects relied on intuition and experiment to give their buildings structural soundness; we will examine the designs using a modern understanding of forces and equilibrium, following Newton.

SYLLABUS: The plan is to cover the first 6 chapters of the textbook and chapter 7 as time permits. Roughly this means the following.

1. The Greeks. Straight-edge and compass constructions. The Parthenon.
2. The Romans. Forces in a Roman arch. The Pantheon.
3. Symmetry. Islamic architecture and design.
4. Romanesque and Gothic. Trusses. The great cathedrals.
5. Coordinates in two and three dimensions. The Duomo of Florence.
6. The Renaissance. Proportion, perspective. Palladio's Villas, St. Peter's.
7. Modern arches and domes. Hooke's Principle, the Safe Theorem. St. Paul's, the Gateway Arch.

HOMEWORK: Homework assignments can be completed in pairs and will be due most Fridays in class. Each pair will work together and produce a single paper.

QUIZZES: There will be a short quiz in class every few weeks. It will be based on topics covered in the assignments.

PROJECTS: Each team should attempt the first three projects described on the website. Project 1 is due on March 8 and projects 2 and 3 are due on May 1. Like the assignments, you will work on the projects in pairs, but please do not collaborate with members of different teams.

EXAMS: We'll have a midterm exam in class on Wednesday March 6. The final exam is scheduled for Tuesday May 7 from 8–10am.

HONOR CODE: The Honor Code is in effect for all exams and assignments. You are encouraged to work together in pairs on assignments, but copying in any form or submitting work done by others as your own is a violation of the Honor Code.

GRADING: Grades will be based on a total of 600 points broken down as follows.

Assignments	=	150
Quizzes	=	100
Projects	=	50
Midterm	=	100
Final	=	200