1. **What course does the department plan to offer in *Connections*?**

   MATH 240: Geometry in Art and Architecture
   *To be cross-listed with HUM 240, and team-taught by faculty from Ogden and Potter

   Which subcategory are you proposing for this course?

   Systems

2. **How will this course meet the specific learning objectives of the appropriate sub-category? Please address all of the learning outcomes listed for the appropriate subcategory.**

   (A) Analyze how systems evolve.
   Geometry is a universal part of natural sciences dating back thousands of years. Over time geometry has expanded to include perspective, non-Euclidean and fractal geometry. Students will see how the knowledge of geometry influenced the design and construction of buildings, the evolutions of our musical scales and the layout of paintings.

   (B) Compare the study of individual components to the analysis of entire systems.

   The student will gain an understanding of how mathematicians can evaluate beauty from a geometric perspective. The student will learn to look at their surroundings with different eyes, allowing them to see geometry where before they never noticed the underlying structure.

   (C) Evaluate how system-level thinking informs decision-making, public policy, and/or the sustainability of the system itself.

   In this course, the student will gain an understanding of how art and architecture are evaluated on a geometric perspective, and also how the function or purpose of a religious work of art or architecture is heavily reliant on its underlying geometry and structure.

3. **In addition to meeting the posted learning outcomes, how does this course contribute uniquely to the *Connections* category?**

   While many courses related to architecture appear in the course catalog, none deal with the mathematics and geometry behind architecture in the way MATH 240/HUM 240 does. However, this course investigates art and architecture in ways beyond the mathematical. By team teaching with faculty from Potter College, students have the opportunity to gain an appreciation for the beauty and function of a building, as well as

its geometric structure. This course truly combines skills from Quantitative Reasoning knowledge from Arts and Humanities into a Connections course.

4. **Please identify any prerequisites for this course.**

   Any Colonnade MATH course with a B or better, or a Math ACT ≥ 24, or MPE ≥ 20.

5. **Syllabus statement of learning outcomes for the course. NOTE: In multi-section courses, the same statement of learning outcomes must appear on every section's syllabus.**

   Upon completion of HUM 240/MATH 240, students will
   - Understand the foundations of Euclidean geometry
   - Appreciate the historical significance of the study of geometry
   - Be able to recognize and replicate applications of geometry in art and architecture

6. **Give a brief description of how the department will assess the course beyond student grades for these learning objectives.**

   Students will complete a major project consisting of a proposal, two oral presentations, a progress report, and a final report. The topic will be chosen by the student and should be related to geometric applications of a work of art or architecture encountered in the student's surroundings.

   The project will be assessed on the following points:

   (A) Analyze how systems evolve.
   How did this work of art or architecture come about? What is its history? Has its purpose changed over time?

   (B) Compare the study of individual components to the analysis of entire systems.
   How do the individual geometric components of the structure contribute to the overall appearance, form, and function of this work of art or architecture? Are the geometric components necessary for stability and structure, or are they for aesthetic purposes only?

   (C) Evaluate how system-level thinking informs decision-making, public policy, and/or the sustainability of the system itself.
   In what ways does this work of art or architecture contribute to society, either to an individual or to society as a whole? Could its individual geometric components be changed in such a way to change its contribution to society?

7. **Please discuss how this course will provide a summative learning experience for students in the development of skills in argumentation and use of evidence.**

   Geometry in Art and Architecture will provide students with the opportunity to go beyond the introductory topics of a typical mathematics or art course. Assignments will

require students to think logically to apply the mathematics they have learned in class to assess the art and architecture they find in and around WKU on various levels. This synthetic approach is designed to help students marshal mathematical and artistic evidence in order to explain architectural and geometric structures.

8. **How many sections of this course will your department offer each semester?**

   Initially one, then more as needed.

9. **Please attach a sample syllabus for the course.**

Hum 240 /Math 240 Geometry in Art and Architecture

Room: **Times:** **Spring/Fall 20xx**

Instructors: Office Phone email:

Office Hours

Class Hours

Prerequisite:
Any Colonnade MATH course with a B or better or a Math ACT of at least 24 or an MPE of 20

Textbook:

Calter, P., *Squaring the Circle: Geometry in Art and Architecture*, Key College Publishing, 2008, ISBN 1-930190-82-4

Other sources:
This class has a Blackboard site. Homework and reading assignments will be posted there; you need to check Blackboard regularly.

Course Description:

Euclidean geometry with historical applications in art and architecture, such as tilings, circular and spiral designs, designs of the great cathedrals in Europe, Buddhist stupas in Asia, Islamic art, the development of visual perspective, and musical ratios. This course is cross-listed with HUM 240.

HUM 240/MATH 240 is a Colonnade Connections course that introduces topics in geometry with applications in architecture, music, and art. This course is multi-disciplinary by design, demonstrating the systemic nature of geometry across disciplines. It will be team-taught by faculty in Ogden and Potter Colleges.

Upon completion of HUM 240/MATH 240, students will

- Understand the foundations of Euclidean geometry
- Appreciate the historical significance of the study of geometry
- Be able to recognize and replicate applications of geometry in art and architecture

Content outline:

- Ratio, proportion, and music
- Golden Ratio and Fibonacci Numbers
- Triangles, quadrilaterals and polygons and their use in art and architecture
- The circle, ellipses and spirals and their use in art and architecture
- Solids and polyhedra, and their use in art and architecture
- Origins of visual perspective
- Fractals and Islamic Art

Your duties:
There will be regular homework assignments and short quizzes. You need to work the homework problems to stay current with the class. Some of the homework will be done using a drawing program (Geometer's Sketchpad) on the computer. If you have questions about the homework you need to ask them either in class or come to meet with one of the instructors. You need to work on this class regularly, and it might take at least one hour of work out of class for each hour of class time. Depending on your abilities this time estimate may vary!

A project:
There will be no written final exam. Instead there will a project assigned in the second half of the course.
As part of the project there will be two verbal presentations to the whole class (one short, one longer), a project proposal, a progress report and final project report.
The project will involve much of the methods and tools developed throughout the course. You should look for a partner and a topic for your project. Each group will work on a different project and topics will be selected through consultation with the instructors. We would like you to come up with a project idea you like to work on. It might be related to research you do or some other interests you have. You need to get serious about the topic of your project by the middle of the semester.

Project topics will be suggested by geometric applications that you encounter in you surroundings. Examples of such topics are:

- Windows in Bowling Green. Are there churches, old homes with fancy windows? Make digital pictures of these and describe their geometry.
- Geometrically interesting buildings on campus. Select a building, get floor plans, make digital pictures and describe the geometry.
- A survey of the art pieces all over campus. What can you say about their geometry?
- The art works of Escher and the geometry behind them.
- Any project idea must include something that can be calculated using methods from geometry.

Here is an approximate timeline for the project.

Week 8: Research feasibility of your ideas, settle on a good project topic, and turn in written proposal.
Week 9: Start working on your project.
Week 11: Turn in a written project report.
Weeks 11: Make a brief presentation about your project to the whole class.
Week 12: Continue working on your project.
Weeks 14 - 15: Final project presentation & final project reports due. Note that week 15 is finals week and the final time assigned to our class will be used as presentation time in addition to the last week of classes.

Note that you will be graded on the progress you make throughout the project period, on your communications regarding the project (starting with the proposal), as well as the final product you turn in.

It might happen that the initial topic chosen for you project turns out to be too difficult and needs to be adjusted a bit to make the project workable. This can to be done - but only in consultation and with explicit approval of the modified project by one of the instructors.

Grading:
There will be regular quizzes (about one a week) to test you on homework problems. There will a group project and two tests. The tests are worth 20% of your grade each. The quizzes and homework will be worth 20% of you grade. The project is worth 40% of your grade.

Students with disabilities:
In compliance with university policy, students with disabilities who require accommodations (academic adjustments and/or auxiliary aids or services) for this course must contact the Office for Student Disability, Room 447, Potter Hall. The OFSDS telephone number is (270) 745-5004.

Per university policy, please DO NOT request accommodations directly from the professor or instructor without a letter of accommodation from the Office for Student Disability Services.