Class Meetings

TBD 03:00 PM – 05:45 PM White Hall 324

Instructor

Dr. Kevin Waters, P.E.
138 Tolentine
610-519-7916
kevin.waters@villanova.edu

Office Hours

TBD

Prerequisites

CEE 1601: Civil Engineering Fundamentals

Course Description

This course covers basic principles of GIS as applied in civil engineering projects. An interdisciplinary core project involving a subdivision development in Wallace Township, PA is used to step through the phases of a real civil engineering project and illustrate how spatial data analysis informs each step from site assessment and planning through construction, including evaluation of sustainability. Students will learn how to apply various tools in ArcGIS Pro and develop skills in technical communication through creation of maps, web applications, and online story maps. Additionally, students will be introduced to tool automation through built-in model building capabilities in ArcGIS Pro and through introduction to python, a commonly used programming language. This course leverages cutting edge software to teach students about key civil engineering concepts while encouraging student independence, creativity, and critical thinking skills throughout.

Course Objectives

1. Understand GIS setup, terminology, and applications.
2. Relate the phases of project planning and design and how spatial data informs each phase.
3. Organize large geospatial datasets using data management techniques.
4. Apply GIS tools and techniques to analyze spatial datasets relevant to civil engineering.
5. Present technical information, data, or analysis results clearly in map, web, or graphical format.
6. Evaluate components of sustainability in each phase of a civil engineering project.
7. Begin to develop self-learning and exploration skills in a computer program.

Course Materials

Textbook: None required.

Course Blackboard page: Primary source for class notes, assignments, project documents, and other supplemental materials. Data may also be posted to the Blackboard page.

ArcGIS Online course page: Primary source for shared data (maps, layers, etc.) and submissions.

Esri Online Support: Students are strongly encouraged to utilize free online Esri support and trainings to supplement other course materials and further explore ArcGIS Pro capabilities. Links to relevant webpages and videos will be provided, as appropriate.

Grading Policy

Each student's course grade will be calculated as follows:

    40% -- Core Project (20% Part 1, 20% Part 2)
    35% -- Individual Assignments & Projects
    15% -- Learn ArcGIS Lesson & Presentation (10% Lesson 1, 5% Lesson 2)
    10% -- Participation (attendance, in-class activities and contributions, peer evaluations)

The scale used to assign letter grades is below. Standard rounding rules will be applied.

Letter Grade	Numerical Grade	Letter Grade	Numerical Grade
A	94 to 100	C	73 to 76
A-	90 to 93	C-	70 to 72
B+	87 to 89	D+	67 to 69
B	83 to 86	D	63 to 66
B-	80 to 82	D-	60 to 62
C+	77 to 79	F	< 60

Additional Course Details

ArcGIS Online

Every student will have an ArcGIS online account created for them. This account enables access to ArcGIS Pro if there is an internet connection. Additionally, sharing of course materials will largely be done through the ArcGIS Online group called **GIS for CEE**. Each student will have their own folder on ArcGIS Online that only the instructor can access for purposes of assignment submissions.

Core Project

The core project site is an undeveloped tract of land in Wallace Township, PA.

Part 1 of the project requires student teams to perform due diligence of the existing site using spatial data and analysis, then to develop a conceptual layout for the subdivision based on their findings and other local ordinance requirements.

For **Part 2** of the project, student teams will be provided with GIS data for a subdivision plan as designed by a real engineering firm. Teams will be required to construct datasets and analyze various elements of the proposed design, including impervious coverage calculations, stormwater inlet sub-basin delineations, cut-fill calculations, and cost estimate preparation.

Each part of the core project will culminate in student presentations where teams present their design and/or findings in an ArcGIS StoryMap. Presentations will be assessed using a rubric provided to the students at the time of project assignment. Peer evaluations will be submitted by each student upon project completion to assess contributions of their team members.

Instructional Details

Instructional Hierarchy

Mimicking ESRI's model for GIS instruction, this course will utilize varying levels of scaffolded in-class and out-of-class activities to teach students civil engineering concepts and ArcGIS Pro tools. The levels and primary application of each are as follows:

- **Level 1**: Demonstrations (in-class, instructor and/or student-led)
- **Level 2**: Scripted activities (primarily in-class)
- **Level 3**: Expanded script activities (in-class and out-of-class)
- **Level 4**: Directed projects (in-class and out-of-class)

In-class activities will be scaffolded to promote class discussion and provide real-time feedback and support, increasing with complexity as students develop skills in the software while hands-on support is decreased. The Core Project is an overall theme of the course, which is linked back to many of the planned activities. Specifically, Level 2, 3, and 4 activities will involve tasks that either directly satisfy Core Project requirements or ones that teach necessary skills and tools that can later be applied to the Core Project.

Active Learning

This course will implement a variety of in-class activities to promote active learning, including in-class demonstrations, tutorials (scripted projects), GIS data scavenger hunts, data collection on campus for integration with the program, and gamification through personal response systems (e.g., Kahoot!, Poll Everywhere).

Course Schedule

The course schedule is shown below, including how the **five key learning areas** are integrated throughout the course.

Week	Topic(s)	Key Learning Area(s)
1	Course Overview; Introduction of Core Project (CP) - Part 1	Fundamentals of GIS, Data Management
	GIS Fundamentals: Program setup, data types and attributes; searching data	
2	Georeferencing: Coordinate systems and transformations	
3	Mapping Basics: Creating static maps and web maps; advanced feature layer symbology	Fundamentals of GIS, Technical Communication
4	Spatial Analysis: overview of spatial analyst tools; surfaces; evaluation of site conditions and constraints	Project Planning, Analysis
5	Student Presentations: Learn GIS Lessons	
	Editing Features: Creating and modifying features; feature attributes	
6	Computational Analysis I: Introducing Python through Applications	Analysis
	CP Working Session	
7	Student Presentations: Conceptual Layouts for Core Project (Part 1)	Technical Communication
	Guest Lecturer(s): Applications of GIS in Research	
8	Introduction of Proposed Design for CP - Part 2	Data Management, Analysis
	3D Analyst: Contours, raster surface creation, terrain creation	
9	Hydrologic Analysis: Watershed delineation and runoff calculations	
10	Computational Analysis II: Applications of Model Builder	Analysis
11	3D Visualization: Scenes, feature extrusion, and animations	Technical Communication
12	Construction Calculations: Existing vs proposed profiles and cross-sections; cut/fill calculations; quantities and cost estimation	Analysis, Technical Communication
13	Asset Management: Data collection, organization, and inventories	Data Management
14	Student Presentations: Final Analysis Results for Core Project (Part 2)	Analysis, Technical Communication
	Course wrap-up and CATS	

Disclaimer: This schedule is subject to change at the discretion of the instructor. Students will be made aware of any changes and this syllabus will be updated accordingly.

Color	Course Segment
	Fundamentals and basic tools
	Project planning and site assessment
	Design analysis

Attendance

Attendance is mandatory at all class meetings. Where possible, students should inform their instructors if they plan to be late or absent from class. In all cases, students should be prepared to provide documentation to petition for *excused* absences to the Associate Dean for Student and Strategic Programs, Dr. Stephen Jones. Students should use the [form for requesting an *excused* absence](#). Excused absences do not count toward a failure in the course for first year students. Absence from class does not release the student from work assigned. Students who miss an in-class obligation (exam, presentation, etc.) due to an excused absence will not be penalized - the instructor may offer a make-up test, arrange an alternative time for a presentation, exempt a student from the assignment, or provide another arrangement.

The University's list of excused absences for all students includes the following:

- participation in NCAA athletic competitions
- participation in special academic events (e.g., conferences, field trips, project competitions)
- participation in official university business (e.g., student representatives attending meetings related to university governance)
- attendance at significant events involving the immediate family (e.g., funerals, weddings)
- religious holidays - see the University's policy on Religious Holidays
- college-approved participation in placement activities (e.g., job interviews, graduate school interviews, attending job fairs)
- documented serious illness or disability

Students are expected to be attentive and respectful contributors to each class.

Academic Integrity

The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs.

Students are encouraged to read the [University's academic integrity policy](#).

The College of Engineering has adopted the following exam guidelines:
- Students must arrive before the start of the exam. Under exceptional circumstances a student may need to arrive late, but he/she can enter the exam no later than 5 minutes after the start of the exam.
- No student will be allowed to leave the room during the exam unless it is an emergency.
- All cell phones must be turned off and stored away until the student exits the exam room.
- The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an exam.
- Each student must <u>write and sign</u> the following statement, "*I have neither given nor received any unauthorized assistance in the completion of this exam.*"

General rules of academic integrity also apply to individual assignments and projects. While group work is acceptable, **copying other students' work or solutions from an online source is not acceptable, and will be treated as a violation of academic integrity**. If you have any questions or need clarification of the policy, it is your responsibility to contact the instructor.

Students with Disabilities

It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability, please contact me after class or during office hours to make arrangements.

If you have a non-physical disability you need to register with the Learning Support Office by contacting 610-519-5176 or at learning.support.services@villanova.edu as soon as possible. Registration is needed to receive accommodations.

The Office of Disability Services collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The ODS provides Villanova University students with physical disabilities the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact and register with Gregory Hannah, advisor to students with disabilities @ 610-519-3209 or visit the office on the second floor of the Connelly Center.

Electronics Policy

The use of electronic devices, such as phones, laptops, tablets, etc., during class is **not permitted in class** unless they are being used to take notes (instructor approval required) or as part of an instructor-led demonstration or learning exercise.

Students are prohibited from making any audio or visual recordings (including taking photographs) of lectures, discussions, or other classroom activities, unless a student (1) has written permission in advance from the instructor, or (2) is permitted to record under terms and conditions as approved by the University's Office of Disability Services or Learning Support Services. Students who have received approval to record classes as an academic accommodation must provide supporting documentation from the Office of Disability Services or Learning Support Services in advance of any recording. Students may use authorized recordings only for the purposes of individual study in the course and may not disseminate or share them with a wider audience without explicit permission.

Copyright Policy

The materials used in Villanova University courses ("Course Materials") generally represent the intellectual property of course instructors, third parties and/or the University which may not be disseminated or reproduced in any form for public distribution (e.g., sale, exchange, etc.) without the written permission of the course instructor. Course Materials include all written or electronic documents and materials, including syllabi, current and past examination questions/answers, and presentations such as lectures, videos, PowerPoints, etc., provided by a course instructor. Course Materials may only be used by students enrolled in the course for academic (course-related) purposes.

Published course readings (book chapters, articles, reports, etc.) available in Blackboard are copyrighted material. These works are made available to students through licensed databases or fair use. They are protected by copyright law, and may not be further disseminated or reproduced in any form for distribution (e.g., uploading to websites, sale, exchange, etc.) without permission of the copyright owner.

Follow these links for more information about intellectual property, copyright, and computer acceptable use.

Adherence to the Student Code of Conduct and the CARITAS Commitment

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to University regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

Students, faculty, and staff are expected to comply with the CARITAS Commitment. Students must wear masks (unless they have a medical exemption), practice social distancing and good hygiene, wipe down their work area upon arrival and departure, and request an excused absence if they are not feeling well.

Permissions

I give the Villanova Institute for Teaching and Learning (VITAL) permission to share this syllabus and post to their website.