Fall 2024

CE 494 - 105: CIVIL ENGR DESIGN I

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CIVIL AND ENVIRONMENTAL ENGINEERING
NJIT New Jersey Institute of Technology

CE 494 – 105 + HM1 Civil Engineering Design I – Fall 2024

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Schedule: Wednesday in person 6:00 PM – 8:50 PM CKB 215

In case there is a need for online meeting:
https://njit-edu.zoom.us/j/5420885917?pwd=bGhETVl5MVlwVmg3b0RWTzkwTkZnZz09

Meeting ID: 542 088 5917
Passcode: 008474

Prerequisites: CE 210, CE 260, CE 320, CE 321, CE 350, CE 341, CE 341A, senior standing

Texts: No textbook. Handout materials only.

Outline: This course simulates the submission and acceptance process normally associated with the initial design phases of a civil engineering project. This course familiarizes students with the preparation of sketch plats, preliminary engineering design, and a related environmental assessment. Requirements of this project include written submittals as well as oral presentation in defense of the project.

Meeting Session	Lecture Topic
Session 1	Introduction to land development, CAD data management, boundary surveys & topographic maps, project management.
Session 2	Project specifics: Location, history, prior use, proposed use, overall significance, and value engineering.
Session 3	Technical attachments & reports associated with the site, survey files, geotechnical report, environmental reports, stormwater issues associated with site, existing conditions that lead to problem statement.

Session 4	Proposed alternatives, descriptions. Includes circulation, zoning, setbacks, density, variances.
Session 5	Design considerations and approach to produce solution that is compatible with engineering standards, green design, ADA accessibility, and other considerations.
Session 6	Drainage analysis, permits required, and hydraulic reports.
Session 7	Traffic analyses, HCS, assumptions, and level of service.
Session 8	Site visit.
Session 9	Complete sample of engineering plans, review, and analysis.
Session 10	Continue review and analysis of sample engineering plans.
Session 11	Engineering design packet and checklist.
Session 12	Review student progress plans.
Session 13	Presentations
Session 14	Presentations
Session 15	Course summary, closing comments and remarks.

Topics learned depend on site selected. Typically the following topics are covered:

1. Introduction to project site, zoning requirements and other constraints.
2. Subdividing property.
3. Roadway design.
4. Grading plans.
5. Environmental impact analyses and report.
6. Stormwater management system design.
7. Soil program and sediment control.
8. Quantities and cost estimate.

Academic Integrity:

"Academic integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. **Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.** If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"

Attendance: Students are required to attend all lectures. Class recordings are not permitted without instructor permission.

Outcomes Course Matrix – CE 494 Civil Engineering Design I

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Apply a simulated submission and acceptance process normally associated with the initial design phases for a civil engineering project. Prepare sketch plats, preliminary engineering design, and a related environmental assessment.			
Present an open ended civil engineering practice design problem for solution by teams of students.	1, 2, 3, 5, 7	1, 2	Final project report and periodic progress reports.
Discuss specific code, performance, cost, time, quality and safety objectives.	2	1, 2	Final project report and periodic progress reports.
Work individually and within multi-disciplinary design teams.	1, 2, 5, 7	1, 2	Final project report, periodic progress reports, oral presentation of project.

Program Objectives Addressed: 1, 2

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our program educational objectives are reflected in the achievements of our recent alumni:

1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward safe, practical, resilient, sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law

through further education.

3 – Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Course Materials

A. Site base maps including boundary and topography data (CAD data).
B. Regulatory code as required.
1."Residential Site Improvement Standards", www.nj.gov/dca/divisions/codes/offices/rsis.html

2. NJ Stormwater Management Rules www.state.nj.us/dep/watershedmgt/rules.htm

3. Municipal bulk zoning table (CAD data).

4. NJDEP Stormwater Best Management Practices Manual and Rules www.njstormwater.org/bmp_manual2.htm

C. Reference Materials
1.Bergen County Soil Survey http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

2. Design software and manuals for stormwater management and sanitary conveyance design.

3. NJDEP Nonstructural Stormwater Points System (NSPS) http://www.njstormwater.org/index.html

4. Supplementary materials for student review

5. MUTCD, MLUL, RSIS, AASHTO and other State and Federal Manuals

6.Additional online data and mapping resources, i.e. Google Earth, Flash Earth, NJ IMap, etc.

7.Textbooks from previous preparatory courses as well as other related references as required.

8. Reports and materials handed by Instructor

Course and Project Report Requirements

Project Plans: Utilizing the above mentioned material each team (5 student's max. per team) will subdivide a parcel of land for single family homes or midrise condominium.

Oral Presentation: For the final oral presentations, each team member will present their work to the class by discipline, i.e., transportation/planning, geotechnical, hydraulics/water resources, and environment. You are expected to dress and present yourself in a professional manner. Presentations shall be direct and comprehensive. Each team will be allotted 15 minutes to present their project to a mock planning board in an attempt to be granted approval by the board.

Planning Board Summary: Students are also required to attend one local planning or zoning board meeting and prepare a summary report. This shall be one to two pages documenting and discussing the student's findings and opinions on the public meeting and the applications before the board.

Computer Data and Computations: Students are required to use available computer applications for required computations in support of the information shown on the plans, profiles and in the reports. Several applications will be available at the NJIT computer facility and outside sources may be used.

Teams: The class will be divided into multiple teams. Each team will use a multidisciplinary approach. That means that each team member will assume a discipline-specific role on the project as follows: transportation engineer, planning engineer, geotechnical engineer, water resources engineer and environmental engineer.

Team Leader: You will also designate a team leader. The team leader is the project manager and shall coordinate and manage the project. The team leader will assign discipline-specific roles to team members. Teams are expected to take the project from preliminary design through to the final design report and oral presentation. This discipline-specific approach should not prevent one member of the team from helping out another member of the team. In fact, with four disciplines and three members to a team, all team members will collaborate on one of the four disciplines. Each student is responsible for the work in one discipline and must work with his/her team members on a second discipline. The division of project work among the four disciplines is as follows:

- Transportation and planning – Subdivision and bulk zoning compliance, horizontal and vertical road design, traffic analysis.
- Geotechnical – Lot grading, pavement design and soil erosion control and soil movement (cut/fill) volumes.
- Water resources engineer – storm sewers, water quality devices, detention basin.
- Environmental – Project report editor, cost estimate, sanitary sewer system, environmental impact statement and wetland delineation (Transition areas if required).

Cost Estimate: You are to use the resources in the library, online or whatever resources are available and prepare a cost estimate of the public site improvements only (stormwater management system, roadway, etc. You are not to include the cost of developing the residential lots.

Feasibility: Finally, you are to insure the project is feasible for development by meeting local bulk zoning, the "New Jersey Residential Site Improvement Standards", and the "New Jersey Stormwater Rule". The final report is used to document that the project meets the governing code. All governing code shall be referenced in the report.

Reports: Reports shall include appendices that include **all** calculations for the storm water management system, traffic, and environmental assessments.

All calculations are to be initialed by the designer and the person who checked the calculations. Credit will not be given for unsigned calculations. All your reports are to be concise, well-thought-out and presented in a professional format. The report should explain what you are constructing, where you are constructing it and how these new improvements meet the governing codes. The final report shall document the change in land use, residential density and compliance with governing land development rules and regulations (Local Bulk Zoning , RSIS, Stormwater Rule).

Please remember there will be **no extensions granted** so use the semester time wisely. Many students underestimate the time required to learn the software, design, organize, publish and present the subdivision design. Students are asked to consider carefully the time required to learn the design process and all of the software required to publish this data. Make copies of your submission as the projects submitted will not be returned.

Minimum Requirements for Maps and Reports

Drawing Standards:

1. All existing and proposed property line print black with varying widths.
2. All existing features and contours print in shades of gray with varying widths.
3. All proposed conditions are to print bold black or in color with varying widths.
4. All printed plan labels shall be legible with the naked eye and shall be submitted in an ordered stapled set. The following shall appear on all maps.

Unit Precision and Format – All plans:

1. Contours, P=0.
2. Distances, P=0.01.
3. Elevations, P=0.01.
4. Radii, P=0.01.
5. Angles, DMS to one second (N 90d 45' 33" E).
6. Stations, P=0 for centerline markers at 100', P=0.01 for location.
7. Area, P=0 for square feet, P=0.001 for acres.
8. Volume, P=0 for cubic feet and cubic yards.

Content and Format

All reports shall be typed and presented as a professional report with a cover sheet, table of contents and letter of transmittal. The group number shall be included on the first page or cover of all documents.

Specific reference to all assigned regulatory code is required in all sections. This course will focus on the class assigned municipal/local bulk zoning code and New Jersey Administrative Codes, NJAC 5:21 (RSIS), NJAC 7:8 (The New Jersey Stormwater Management Rules) and the New Jersey Stormwater Best Management Practices Manual.

Reports shall document how the project design conforms to the code and defend any variance and/or waiver relief required. All groups must attempt to design without waiver or variance relief. Any request for design relief must be presented to the course instructor for preliminary approval at least two (2) weeks prior to the final submission date. No design relief will be granted after this date.

Honors Classes

In addition to Sections I through V above honors classes are required to:

1. Compose written legal descriptions for all proposed parcels and easements.
2. Design an outlet control structure and provide a final detention basin design. Construction details are to be provided for the detention basin and outlet control structure.

Final Submittal

Report is optional (No grade) and may include:

1- Introduction: site description, aerial, general location, history, prior use, and overall outlook for the area.

2- Existing conditions: Description and problem statement

3- Environmental elements: Use the report included with the package to highlight the main issues and executive summary

4- Geotechnical Elements: Use the report included with the package to highlight the main issues and executive summary

5- Proposal site description: Use, circulation….

6- Design Considerations and approach: Applying engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors: Such as Green design, ADA accessibility, economical need for the current market and economy (apts….)….

7- Approach and methodology: Acquire and apply new knowledge as needed, using appropriate learning strategies such as analyzing traffic counts, HCS, CAD, Calculations of transition length and other design criteria of AASHTO, MUTCD

8- Drainage calculation, size the detention system, pipes

9- Traffic reports and analysis, calculation of LOS of intersection or circle using appropriate software

10- Cost estimate for your construction site work, do not include the actual building cost

11- References: List of all references you used: RSIS, AASHTO, MUTCD, reports,…

Plan Set (Your Grade is based on the following):
*Refer to sample Essex Street drawings in your package for more details indicated on each sheet.

1. Cover sheet: North arrow, keymap, address, scale, date, a place holder chart for properties owners within 200 ft (you do not to have actually list the individual owners for the sake of time limitation), utilities list, project name, block and lot. Quantity chart, and units (no pricing). List of all drawings in the set with page number.
2. Existing plan
3. Proposed subdivision: Prepare a subdivision plan depicting and dimensioning the following.
    a. Title Box, north arrow, scale.
    b. Existing ground features. No contours or elevation data.
    c. Existing and proposed right of way (R.O.W.), lot lines and protected or restricted lands.
    d. Alignment controls such as PI, PC and PT points as well as CL curve radii labeled.
    e. Proposed road names and widths.
    f. Proposed parcels numbered with areas reported in acres and square feet, lot lines and curves with meets and bounds labeled.
    g. Zoning table identifying bulk zoning compliance and any required variance for each lot.
    h. Proposed easements labeled with name, area and meets and bounds.
    i. Call out labels
4. Proposed siteplan: Foot print of building, floor elevation, areas, access, traffic control device, parking, road, mandatory road widening.
5. Construction drawing, cross section, longitudinal profile, quantity calculation, show all of the work that will be done in the field, include ADA Ramps.
6. Pavement plans: Maybe also included with construction drawing
7. Utility plans, drainage, relocation of utilities….
8. Signing and striping plans, ADA, crosswalks, stop bars, lane striping, arrows, paint quantities
9. Detail Sheet: shows all details that are used, such as curb, manhole, inlets, plantations….
10. Drainage calculation
11. Traffic analysis & Cost Estimate.

One combined PDF file, named by the class – section - group individual name Last name first: CE494-SectionXXX_Brown Tom - Smith Eric - .pdf

PDF file includes your report, a set of plans, and presentation materials. USE PDF Pro to combine everything into ONE PDF document.

Instructions for printing to PDF

1. Set Name to DWG to PDF.pc3
    a. Properties
        i. Custom properties
            1. Additional output setting
                a. Uncheck “Include layer information”

Additional Notes:

1. Attendance will be taken at the beginning of the class and may affect your final grade.
2. In case of any student misses a class, or fail to submit assignment or presentation on time, the Office of the Dean of Students is the only entity that would determine the legitimacy of the absence or the situation via a written email addressed to the course instructor.
3. It is the student's responsibility to contact the office mentioned above and make his/her case with proper documentations.
4. Students within the same group, may get different grade based on class & group participation.
5. Planning Board attendance, and summary report is mandatory as part of the project but will not be graded.
6. The class will cover more materials than what is covered in the project submittal, it is advised to read the entire handout.

Due date: Wednesday November 13, 2024

Plan Submittal Presentation: Elaboration on your plans, cost estimate, traffic and drainage calculation.

Please note that the class will cover more materials than the submitted project.

Revised: JB 08/13/2024