A Modular Approach to Course Development

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**CEE 2804**

**INTRODUCTION to CIVIL ENGINEERING**

200 students each fall (whole sophomore CEE class)
15 faculty members
7 TAs
COURSE THEMES

• Civil disciplines and definitions
• Social, scientific, and symbolic perspectives
• Civil engineering history
• Current events
• Engineering critique

COURSE OBJECTIVES

• recognize the breadth and specialty areas within the civil engineering profession;
• identify the components of the civil engineering undergraduate program of study and graduation requirements;
• identify Civil Engineering work in the surrounding community through local field trips;
• recognize the importance of the ASCE Code of Ethics and apply its principles to civil engineering practice;
• recognize contemporary civil engineering issues and the impact of civil engineering solutions on society; and
• conduct written and verbal communications in a professional manner.

Sustainability and resilience too!
COURSE STRUCTURE

• 20 large group lectures
• 11 discussion sessions

Emphasis on linking large group themes to small faculty-led sections

COURSE GOALS

• Excite students about their profession
• Create an atmosphere where students can get to know a CEE faculty member
• Flexible faculty workload

There are plenty of opportunities for faculty to contribute to the themes and content of the course.
### LARGE GROUP LECTURES

<table>
<thead>
<tr>
<th>Lecture Date</th>
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<th>Topic</th>
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<tbody>
<tr>
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<td>1</td>
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</tr>
<tr>
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<td>Engineering critique - final project preparation</td>
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The goal is to touch on all of the CEE subdisciplines in interesting ways. Lectures, case studies, guest speakers, live demonstrations…
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Need to work more on emphasizing interdisciplinary links and collaboration.
LARGE GROUP LECTURE EXAMPLE

Stormwater management and water resources engineering
Why do floods occur?

What is this?
“When the storm struck western Pennsylvania it was the worst downpour that had ever been recorded for that section of the country. The Signal Service called it the most excessive rainfall of the century for so large an area and estimated that from 6 to 8 inches of rain fell in 24 hours over nearly the entire central section.”
South Fork Dam Cross-Section
Q = A * V
Q = Discharge (cubic feet per second)
A = Cross-sectional flow area (square feet)
V = Mean flow velocity (feet per second)

A = W * D
W = Width (feet)
D = Average depth (A/W)
South Fork Creek

Drainage Area: 48.6 square miles

May 31, 1889:

\[ W = 120 \text{ ft}, \; D = 10 \text{ ft}, \; V = 8 \text{ ft/s} \]
\[ Q = 9,600 \text{ cfs} \; (198 \text{ cfs} / \text{square mile}) \]

\[ V_s = 0.5t_b(Q_p - Q_a) \]
DISCUSSION SESSIONS

- faculty intro
- 2 field trips
- 2 presentations (over 4 class periods)
- 2 peer reviews & discussion
- 1 open session
- final project workshop (help students with thesis statements)

FIELD TRIPS

Smart Road
Drinking Water Treatment Plant
Bridges on Rt 114 over the New River
Campus buildings under construction
CAVE
Blacksburg Town Engineer’s Office
CEE Research Labs (Structures & Materials; Geotech; Water Res)
Anderson & Associates Office
Draper Aden’s Office
VT Airport & Tower Simulator
ICTAS II – Green Building
College Avenue Promenade
Covered Bridges – Mountain Lake
ASSIGNMENT EXAMPLE – Structural…

### Structural Significance

The Eiffel Tower, designed by Gustave Eiffel and completed in 1889, stands as a testament to innovative engineering. Its use of iron, a relatively new material at the time, allowed for the construction of a tall, lightweight structure. The lattice framework not only provided stability but also facilitated maintenance and repair, a feature that was revolutionary for its time.

### Design Considerations

#### Historical Context

The tower was initially designed to be a temporary structure for the 1889 Exposition Universelle in Paris. However, its popularity led to its permanent installation. Gustave Eiffel’s expertise in iron construction was evident in the tower’s design, which combined aesthetic appeal with functional efficiency.

#### Structural Analysis

1. **Wind Load Analysis:**
   - **Wind Pressure:** Use structural analysis software to calculate the wind pressure acting on the tower.
   - **Structural Integrity:** Determine the critical sections where the wind load is most significant.

2. **Temperature Effects:**
   - **Thermal Expansion:** Analyze the tower’s response to temperature changes, considering its expansion and contraction.
   - **Seismic Analysis:** Assess the tower’s performance under seismic events, ensuring its stability.

### Conclusion

The Eiffel Tower represents a significant milestone in engineering history, showcasing the potential of iron as a building material. Its design and construction continue to inspire modern engineers to push the boundaries of structural integrity and aesthetics.

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**VT CEE Infrastructure**

### Assignment Guidelines

Select a civil engineering infrastructure site on campus that you have personally visited for this assignment. Collect basic facts and formulate some thoughts about the site you select. Provide the following in a nicely typed up document:

- **Description:**
  - Location and all other basic facts you find

- **Reason:**
  - Why you selected it (site)

- **Analysis:**
  - How its design was influenced by at least two civil engineering subdisciplines

- **Revenue:**
  - Write a report about the site’s financial aspects

- **Analysis/Conclusion:**
  - Include your analysis and conclusion in your report

### Due Date

Upload your PDF to Scholar by Wednesday, September 18 at noon.
ASSIGNMENT EXAMPLE – Water resources

On July 19, 1996, western Pennsylvania was hit with widespread flash flooding. The flooding, which was seen across six different counties, was a result of a large number of thunderstorms moving through the area. The Excel spreadsheet found on Scholar titled StormData.xla contains rainfall and discharge observations from Redbook Creek for that day. The discharge sheet has seven columns – year, month, day, hour, minute, hour counter (starting at 0.25 hours at 12:15 am, July 18th), and discharge of Redbook Creek (in cubic feet per second). The Rainfall Rate sheet has five columns – year, month, day, minute, and rainfall rate (in millimeters per hour) averaged over the 1560 square kilometer drainage basin. Using the given information, calculate the following:

2. Create a plot of discharge versus time. Label x and y axes.
3. Create a plot of rainfall versus time. Label x and y axes.
4. What is the peak discharge rate? At what time did this occur?
5. What is the peak rainfall rate? At what time did this occur?
6. Why is there a difference between the time of peak discharge and the time of peak rainfall rate?
7. To reduce the risk of future flooding, western Pennsylvania has decided to create a detention basin to try to control the rate of flow during large storm events. Read the following notes about detention basins and use the given equations to estimate the volume of water that the basin will need to hold. Assume the maximum detention outflow is 156 cubic feet per second (cfs).
Overcoming Potential Challenges to Course Development

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Course development and adoption will be successful if it is tailored to work within the existing curricular structure with the support of your colleagues inside and outside your department and by priming the students early in course.
Working with the curriculum, not against it

It was easier to update an existing course than start a new course at Virginia Tech.

Approval was direct with the Dept. curriculum committee.

Support of Dept. chair(s) is essential.

Faculty support

If you make the course easy to interact with, then your colleagues will be happy to participate.

This means small bites - invite them to give a class demonstration, ask them to provide a grad student to develop a HW assignment, …

Take some time to educate faculty about the overall ideas of the course - social, scientific, symbolic, critique, …
Student priming

Engineering students are trained to plug and chug and so thinking critically is very, very uncomfortable for them.

Provide them with lots of examples and definitions right away, at the beginning of the course. What are scientific, social, and symbolic perspectives to civil engineering infrastructure? What does critique mean? How do you critique something? You mean I can take any position I want? Are you crazy professor?!