



# Senior Capstone Design Courses

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# Senior Capstone Design Projects

- ▶ With no boundaries, no textbooks, and no solutions manuals, the students are challenged to apply laboratory and classroom experience on a real-world scale to interdisciplinary senior design projects, as part of their culminating work prior to graduating.
- ▶ Often, projects were presented to an audience of faculty, students, and company professionals



# Why ABET Focus on Senior Capstone Design Courses

- Typically, Senior Capstone Design courses will incorporate actual design projects that engineers might encounter in their practice
- These are courses that reflect the readiness of graduating engineers for the upcoming challenges in their professions
- Projects can be initiated either by faculty members, students, or private sectors



# Key Elements (SOs) Included in Most Capstone Design Courses

- Multi-disciplinary teams (typically a team of four)
- Design a system, component, or process
- Problems solving and innovations
- Communication effectively (report, drawing, and presentation)
- Utilize modern engineering tools (software, drone)
- Life-long learning



# CE Senior Design I –Site Planning

- Stimulates the submission and acceptance process normally associated with the initial design phases for a civil engineering project
- Familiarizes students with the preparation of sketch plats, preliminary engineering design, drainage system, and a related environmental assessment
- Requirements include written reports, drawings, and oral presentations in defense of the project

# Topics included in the Design I Project

**Depends on Site Selected. Typically, the following topics are covered:**

- Introduction to project site, zoning requirement and other constraints.
- Check boundary and Area
- Street Design
- Lot Design
- Grading Plans
- Environmental Impact Analyses and Report
- Sanitary Sewer Design
- Stormwater Collection Design, Stormwater Management Design
- Soil Program and Sediment Control
- Potable Water Analysis
- Quantities and Cost Estimate





# CE Senior Design II -Structures

- Students are provided with the type of design experience they would receive if engaged in a specific area of civil and environmental design practice.
- Offerings are made in various design areas, structures, geotechnical engineering, transportation and planning, and sanitary and environmental engineering.

# KPI Tower, Bangkok a 24-story Office Building on Silom Road





# Mahanakorn Tower, Bangkok a 75-story Luxury Residence Building





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# 40 Story Noble Condominium Ratchada

FLOOR PLAN : 7-37



NOBLE REVOLVE RATCHADA : 7<sup>th</sup> - 37<sup>th</sup> FLOOR

# 40 Story Noble Condominium Ratchada





NOBLE REVOLVE RATCHADA : 6<sup>th</sup> FLOOR





# Steps for Capstone Design II -Structures

- Students are given the architectural drawings of the building similar to what structural engineers will receive when they start designing a building
- From these architectural drawings, students have to design their own structural floor plan and layout. Typically, each group will have their own design logic and proceed to design the whole building

# Steps for Capstone Design II -Structures

- Once the floor plans are completed with proper layout and labels of beams, slabs, columns and footings, they will then start to
  - Carry out structural analysis. Typically, this step will be done using computer software
  - The resulted values of member force, moment, shear, and deflection will then be used for design (steel or concrete).
  - Full scale drawings for all floor plans, slabs, beams, columns, and footings will be done using AutoCAD and some other software (up to the students to choose)
  - Each group must prepare all drawings together with their design calculations
- To complete the project each group is required to make formal presentation of their design



# Four Options for Capstone Design Projects at Purdue University

Students typically have four options for their projects:

- 1. They can **propose their own projects**. Such proposals have to be submitted early in the previous semester and have to be vetted by the Director of Senior Design. The value of this option is that it allows students with specific interests to propose a project in an area they are passionate about.



# Options for Capstone Design Projects

- 2. Students can participate in a **faculty-sponsored project**. Many faculty have creative project ideas for devices they need designed and fabricated. Very sophisticated projects such as a spinal testing machine has been developed via this mechanism.



# Options for Capstone Design Projects

- ▶ 3. Students can participate in an **industry-sponsored project**. Each semester we have a number of companies that sponsor a variety of projects. The company provides funding for the project as well as technical expertise to help get students up to speed on their projects and serve as a resource for future questions





# Options for Capstone Design Projects

- 4. Some students participating in significant design competitions (such as ASME Design Competitions) can utilize these projects for their capstone experience



# Project Samples

## Fully Automated Soccer Trainer

- This compact and automated soccer trainer shoots balls to players at different angles and speeds.

## UAS Driver Behavior Monitor

- Irregular and dangerous driving behavior is the leading cause of traffic accidents. The group designed an unmanned aircraft system (drone) to spot dangerous driving behavior and assesses risks to other drivers.



# Project Samples

## Smart Car Seat

- ➔ The group designed a “smart” infant car seat that provides creature comforts to a traveling infant. It includes an automated feeder, music player, and active health monitoring controlled by a tablet or smart phone app

## Robot Doorman

- ➔ The group designed a robot capable of performing duties of a doorman while maintaining the experience of a human. It can recognize strangers and inform tenants of events such as package deliveries



# Project Samples

## Self-Adjusting Ergonomic Smart Chair

- This automated smart chair reduces the risk of injury by monitoring back and shoulder posture to provide optimal support

## Automated Sample Inspection System

- This system performs inspections on various aspects of product quality, identifying and separating out unacceptable products



# Project Samples

## **Total Plant Care Machine**

- This is an efficient plant care system that plants, fertilizes, waters, and controls weeds. It works in gardens of varying shapes with different types of plants.

## **Fully Automated Gift-Wrapping Machine**

- The group designed a gift wrapping machine that wraps boxes of different sizes with paper that the customer selected.