



# Civil, Environmental and Architectural Engineering

UNIVERSITY OF COLORADO **BOULDER**

## **CVEN 2837 Special Topics: Introduction to Global Engineering (RAP)**

This course intends to introduce students to the historical causes and present conditions of global inequality, and identify the opportunities and limitations of professional engineering engagement. It intends to empower students and working professionals to engage in a historically contextualized, anti-imperial contribution to global engineering. It also teaches students to identify and promote the relevance and role of the engineering profession in supporting the reduction of poverty and increasing prosperity.

## **CVEN 3837 Special Topics: Advanced AutoCAD**

This course focuses on computer-aided drafting and design (CADD) in the civil engineering environment using the latest release of the AutoCAD Civil 3D software packages. The course will begin with a reintroduction to the software, basic tools and techniques, along with concepts in general CADD standards related to civil engineering. Creating and modifying advanced Civil 3D objects will be at the core of the early portion of the course. The focus will then shift to topics, tools, and techniques for civil engineers using AutoCAD Civil 3D. It will include terrain surface modeling, horizontal and vertical alignment design, subsurface pipe design, and the development of construction plan sets using common industry standards.

## **CVEN 4834 Special Topics: Solid Waste**

Covers the scope of the nonhazardous solid waste problem and regulations that drive its management; discussions of non-engineering factors that impact waste management and recycling; design of incinerators, composting facilities, and landfills used to treat and dispose of solid waste.

## **CVEN 4837 Special Topics: Water, Sanitation, Hygiene**

This course will examine current conditions and trends in WASH in low and middle income countries. We will take a critical look at the underlying political, economic, social, and technical reasons why millions of people still do not have safe drinking water and improved sanitation services, and lack hygiene practices that ensure health benefits. We will examine a broad range of WASH interventions and programming. The course will be taught in 3, five-week modules: Drinking Water; Sanitation & Hygiene; Overarching Issues in WASH.

## **CVEN 4837 Special Topics: GIS for Civil & Environmental Engineering Systems**

(CMU Course)

This course intends to teach students to collect and analyze data in a GIS using ESRI's commercial software (ArcGIS Pro). Students will also learn about the use of freely available GIS software to conduct some basic analyses. Students will also learn to collect and analyze topographic data using GPS surveying equipment and Trimble Business Center Software. This includes development of 3D terrain models. This course also teaches students to conduct photogrammetry to create 2D aerial imagery maps using drones and 3D object and terrain models using handheld cameras and drones. Students will also implement advanced GIS techniques and analyses including watershed delineation and hydraulic model development.

## **CVEN 4839 Special Topics: Global Development for Engineers**

In this course, global development refers to both human development, the process of enlarging people's freedoms and opportunities and improving their well-being, and also to sustainable development, development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The goal of the course is to enable you to view global development problems from a number of viewpoints, and to create sustainable strategies for

change. Using a systems approach, different perspectives are studied and encouraged. We will explore opposing views on hot topics such as the legacy of colonization, social justice, trade, aid effectiveness, “business at the bottom of the pyramid,” and microfinance. Emerging trends, e.g. globalization, migration, conflict, urbanization, energy, climate change, food security, social justice, and the impact of COVID-19 will be woven into the class sections. The guest lectures, readings, class discussion, and assignments will teach you to think as an engineer operating within the global development arena. The course makes extensive use of case studies from Asia, Africa, Latin America, Middle East and Eastern Europe. In keeping with the multidisciplinary nature of global development, the readings will reflect a wide range of fields.

### **CVEN 5836 Special Topics: CEM Fundamentals**

The purpose of the course is to provide an overview of the construction industry to establish a foundation for subsequent graduate courses in construction engineering and management. The intended audience for this course is a student with limited prior construction experience or education. Students will be exposed to projects of varying funding sources, contracts, scope and complexity. Project phases will be established including planning, funding, design, construction, turnover, operation and maintenance. The course will focus on fundamental construction cost estimating, scheduling, delivery systems, contractual relationships, key contract clauses, risk allocation, building materials/systems and project controls. Special attention will be paid to emerging technologies and industry trends.

### **CVEN 5836 Special Topics: Infrastructure Asset Management**

This course focuses on the fundamentals of infrastructure asset management, combining engineering principles, business practices, and economic theory to facilitate a more organized and logical approach to decision-making. A framework for asset management will be discussed in detail, including the importance of asset valuation, maintenance needs assessment, and performance monitoring and prediction. Other topics covered in the course will include: decision support systems, life cycle cost analysis and optimization, data analysis in infrastructure management, and sustainability. Although the concepts introduced in this course are applicable to different infrastructure systems, a special emphasis will be given to transportation projects.

### **CVEN 6833 Special topics: Advanced Data Analysis**

Lots of data everywhere, but little knowledge! We face this conundrum in the age of big data. The objective of this course is to provide a good exposure to a variety of statistical learning techniques - both traditional and modern – to help extract knowledge from data. Examples from hydrology, hydroclimatology, environmental engineering and construction safety will be presented - the techniques are general in nature so that they can be easily applied to data analysis problems from any other fields. The course will have a significant hands-on component on the powerful data analysis tool R1 (<http://www.rproject.org>).

### **CVEN 5830 Special topics: Introduction to Humanitarian Aid**

Working toward sustainable solutions requires close coordination among humanitarian and development agencies. Too often this has been hampered by artificial divides. Momentum is building to address disaster refugee this gap and foster greater join-up, and it is critical that professionals from both sector understand the principles that guide humanitarian aid. This course will give an overview of the main principles, standards, and key stakeholders involved in humanitarian response. The course explores the ethical and professional principles that guide humanitarian response to conflict and disaster. Students will learn the legal and historical frameworks that shaped these principles, and test their applicability to the challenges faced by humanitarian actors today. Disaster definition and classification will be presented and the different phases of disaster and crisis management will be analyzed with emphasis on the disaster risk reduction and resilience perspective. The importance of community engagement and accountability will be presented as well as methods to assess community resilience. Both the management of immediate post-disaster humanitarian assistance and the dynamics of longer-term community recovery will be considered.

### **CVEN 5830 Special topics: Disaster Risk Reduction**

The humanitarian community needs to shift from a reactive to a proactive approach. This course discusses disaster governance and global policy perspectives for disaster risk reduction. It focuses on resilience theory, adaptation, and

transformation in societies impacted by disasters. The course explores the issues of participatory disaster governance, the role of decentralization of disaster resources and responsibilities, and best practice in preparedness and mitigation. By investigations of the application of human security and sustainable development principles, the course will take the student into the intersecting research communities of development, climate change, disasters, and poverty alleviation in studying how disasters impact on human, social and political behavior, and how disaster impacted populations respond to these crisis events. Students will learn how to use data, tools, and geospatial techniques (GIS) that can enhance vulnerability assessments, mitigation planning, and response operations.

### **CVEN 5830 Special topics: Refugees and Displacement**

This course gives students an understanding of the major causes of contemporary migration and population displacement. Worldwide, there are over 70 million displaced people. Refugees (those displaced populations that have fled their countries) account for 25.9 million of the displaced population. This course examines the global, regional, and national processes contributing to and driving refugee and migration flows. Contributing factors to be studied include poverty, uneven development, competition for resources, political instability, weak governance, violence, environmental degradation and natural disasters. Engineering solutions, particularly in the settlement context, are examined. This course examines appropriate provision of covered living space to adequately shelter displaced populations, while also promoting safer, healthier settlements that link emergency shelter and settlements (S&S) assistance to longer-term recovery efforts. It covers basics of humanitarian S&S activities, including shelter modalities, the relationship between shelter and its context (settlements), how to promote the recovery of affected settlements, and relationships between S&S activities, disaster risk reduction, sectoral activities, and larger trends.

### **EVEN 4830 Special Topics: Sustainable Energy Systems Analysis**

This course introduces students to the fundamentals of technology utilized in sustainable energy systems. Students will learn performance modeling, environmental life cycle assessment, and economic viability evaluation with a focus on the following: sensitivity analysis of cost-performance models, uncertainty and risk assessment, multi-criteria decision making and sustainability assessment. This course highlights the limits and obstacles facing the integration of sustainable energy technologies into our current energy generation spectrum, and the influence of policy and regulations.

### **EVEN 4830 Special Topics: Contaminant Fate Transport**

This course is designed to give students an understanding of processes that govern the behavior of pollutants in the environment. The subject includes aspects of intermediary transport, surface and groundwater hydrology, air pollution modeling, degradation processes, human exposure pathways, and monitoring. The course requires students to design and conduct experiments, analyze and interpret data, and write technical engineering reports.

### **CVEN 5834 Special Topics: Advanced Water Treatment**

Teaches the process fundamentals of (1) granular activated carbon adsorption (2) UV, ozone and advanced oxidation processes (3) membrane filtration and reverse osmosis treatment and (4) ion exchange. These processes, as applied to impaired water sources, including brackish/saline/saltwater and wastewater reuse, will address water quality parameters including pathogenic microorganism, background organic matter, specific organic contaminants, metals and salts.