

PROGRAM-SPECIFIC COMPETENCIES - CIVIL ENGINEERING

Competencies are the skills, knowledge and attributes gained through every work, educational, volunteer and life experience.

UVic students in the [Civil Engineering](#) program develop the following program-specific competencies. We worked with the Department of Civil Engineering to develop this document.

PROFESSIONAL PRACTICE

Behaves in accordance with the standards and code of ethics of the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC)

- + Prioritizes the safety, health and welfare of public and environmental protection
- + Promotes health and safety within the workplace
- + Undertakes and is responsible for professional assignments only when qualified
- + Maintains confidentiality and avoids a conflict of interest
- + Keeps informed to maintain competence
- + Acts with fairness, courtesy and good faith towards clients, colleagues and others
- + Extends public knowledge and appreciation of engineering

RELIABILITY, SAFETY AND FAILURE ANALYSIS

Develops systems that are reliable and effective by mitigating risk and reducing failure

- + Maintains an awareness of the quality assurance standards and testing procedures
- + Ensures that systems or components perform their required function for the required duration under the stated conditions
- + Maintains a current knowledge and awareness of requisite safety standards
- + Understands the consequences of failure and reduces their impact
- + Establishes the mean time between failures when assessing reliability

DESIGN

Gathers requirements, develops models and creates prototypes in a timely and effective manner to increase a project's safety and success

- + Gathers full requirements for a project
- + Understands the client's needs
- + Models a solution using the appropriate tools
- + Relates and justifies the design process to the client
- + Implements designs that are safe and effective
- + Demonstrates awareness of how the design integrates into its environment

ENGINEERING TOOLS

Uses a broad range of Engineering tools, applications and software.

- + Designs equipment and systems using a variety of software packages
- + Simulates mechanical and electronic systems using the appropriate tools
- + Analyses systems, equipment and data using the correct tools
- + Operates mechanical equipment in a lab or workshop safely and effectively
- + Uses electronics and electrical equipment in a careful and accurate manner
- + Develops software and scripts in a variety of environments and languages
- + Uses computer software and systems in an appropriate manner
- + Understands database concepts and usage and uses them effectively
- + Researches and recommends new tools where existing tools are inadequate
- + Chooses tools based on their comparative strengths and weaknesses

ENGINEERING KNOWLEDGE

Understands the broad scope of disciplines that support engineering theory and practice

- + Demonstrates knowledge of the mathematical fundamentals of engineering
- + Applies the correct statistical methods to analyze and investigate data
- + Understands the supporting natural sciences for their discipline of engineering
- + Maintains a comprehensive knowledge of the engineering fundamentals
- + Demonstrates an understanding of engineering economics
- + Comprehends how engineering specifics integrate into a larger project
- + Studies companion subjects to aid a projects success

Develops the following competencies specific to the Civil Engineering program:

MATERIALS

Applies knowledge of engineering materials and their properties and behaviours

- + Demonstrates an understanding of the property differences between materials
- + Determines project needs by considering the characteristics of specific materials
- + Estimates requirements based on knowledge and experience
- + Optimizes performance and best practices in material extraction and processing
- + Manages the recovery, reuse, recycling and/or disposal of materials
- + Participates in material research and development

STRUCTURES AND MACHINES, STATICS AND DYNAMICS

Identifies, formulates and solves engineering problems that occur with rigid bodies that are in static equilibrium and moving bodies that are in dynamic movement

- + Applies the fundamentals of statics and dynamics to engineering problems
- + Considers forces, torques, stresses and strains in the design process
- + Determines the safe operating limits for structures or machines
- + Works with trusses, cranes, hoists, gear units and ratios
- + Participates in the research and development of structures and equipment

ADVANCED THERMODYNAMICS AND FLUIDS

Solves thermodynamic engineering problems using mathematical formulations

- + Demonstrates knowledge of the fundamental science of fluid dynamics
- + Designs fluid movement systems using the appropriate theory
- + Determines the appropriate pump for the application
- + Designs heat transfer systems from knowledge of different types of heat exchangers
- + Participates in the research and development of new heat transfer

WATER AND ENVIRONMENTAL SYSTEMS

Combines knowledge of water and environmental systems with quantitative analysis and core aspects of engineering

- + Understands water resource systems by applying fundamentals of hydraulics, hydrology and environmental engineering
- + Designs, plans and manages engineered and natural environmental systems
- + Understands sources, characteristics, transport and effects of air and water contaminants
- + Applies fundamentals of civil engineering to solve issues related to biological, chemical and physical processes in water, unit operation or air and water quality control, water and wastewater treatment processes and solid waste management
- + Understands how environmental policy is formed and changed

SUSTAINABLE RESOURCE DEVELOPMENT AND RESPONSIBLE INFRASTRUCTURE

Applies the principles of sustainable design in engineering systems, manufacturing, infrastructure, transportation, communications and community development

- + Applies the environmental and sustainability metrics and life cycle assessment framework in design
- + Evaluates sustainable technologies from a technical, economical, environmental and social perspective
- + Conducts environmental impact assessments, environmental audits, assessments on contaminated sites, site investigation and remediation
- + Understands the behavior and life cycle of materials including steel, timber and concrete using fundamentals of structural engineering
- + Understands building envelopes, building science and green buildingsParticipates in the research and development of structures and equipment

TRANSPORTATION SYSTEMS

Applies the principles of sustainable design in engineering systems, manufacturing, infrastructure, transportation, communications and community development

- + Understands the role of transportation in urban development and planning, including social, economic and policy impacts
- + Evaluates transportation networks, design and flow predictions
- + Designs transportation systems to meet specific planning policies or goals and objectives of the community, including designing in remote communities and public transit systems
- + Identifies and addresses traffic safety issues, including ice roads and mountain highway engineering