



Engineering Certificate (ENGR)

Program Outline

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| PROGRAM IMPLEMENTATION DATE: | September 2012 |
| OUTLINE EFFECTIVE DATE: | September 2023 |
| PROGRAM OUTLINE REVIEW DATE: | April 2028 |

GENERAL PROGRAM DESCRIPTION:

Career paths in engineering include civil engineering (structures), mechanical engineering (machines), electrical and computer engineering (circuits and software), chemical and biological engineering (chemical and biochemical processes), engineering physics (applied physics in the design of new devices), and many more. In general, engineering is for students who are interested in the physical structures and systems in our modern world. Their work involves the analysis, design, planning, construction and maintenance of these structures and systems for reliable and safe use.

Program Information:

The COTR Engineering Certificate follows the BC Common First Year Engineering Curriculum agreement (CFYEC 2020). The COTR Engineering Certificate prepares students to apply for competitive admission to Year 2 programs in BC. Some Engineering streams may have specific requirements that are different than the Common First Year Engineering Curriculum. Students should always contact the receiving institution for details on course requirements and course transfer.

Delivery: Face-to-face and online

COTR Credits: 36

Hours for this program: 795 hours

Typical Structure of Instructional Hours:

| Instructional Activity | Duration |
|------------------------------------|------------|
| Lecture Hours - minimum | 525 |
| Seminars / Tutorials | |
| Laboratory / Studio Hours – min. | 270 |
| Practicum / Field Experience Hours | |
| Other Contact Hours | |
| Total | 795 |

Practicum Hours if applicable:

| Type of Practicum | Duration |
|------------------------|------------|
| On-the-job Experience | N/A |
| Formal Work Experience | N/A |
| Other | N/A |
| Total | N/A |

Program Outline Author or Contact:

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Signature

APPROVAL SIGNATURES:

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Department Head Signature

Dean Signature

EDCO

Valid from: September 2023 - April 2028

Education Council Approval Date

PROGRAM PREREQUISITES AND TRANSFER CREDIT:**Admission Requirements:**

- Minimum 65% in either English Studies 12, English First Peoples 12, ENGL 090, or equivalent (refer to Course Equivalency information on the College Website);
- Either a minimum of 65% in Math 090, Math 100, or Principles 12; or Pre-Calculus 11 AND Pre-Calculus 12 with a minimum of 65%; or Pre-Calculus 12 and a minimum of 75% in Calculus 12;
- Minimum grade of 65% in Physics 12 or PHYS 090;
- Minimum grade of 65% in Chemistry 12 or CHEM 090.

Flexible Assessment FA:

Credit can be awarded for this program through FA

☒ Yes☐ No

Learners may request formal recognition for flexible assessment at the College of the Rockies through one or more of the following processes: External Evaluation, Worksite Assessment, Demonstration, Standardized Test, Self-assessment, Interview, Products/Portfolio, Challenge Exam. Contact an Education Advisor for more information.

Transfer Credit:

For transfer information within British Columbia, Alberta and other institutions, please visit <http://www.cotr.bc.ca/Transfer>

Students should also contact an academic advisor at the institution where they want transfer credit.

ENGINEERING CERTIFICATE:

| BC Common Curriculum 2020 | BC Common Curriculum (Lecture-Lab) | COTR Course | COTR hours (Lecture-Lab) |
|---------------------------|------------------------------------|------------------------|--------------------------|
| | | Fall Semester | |
| ENGR 1 | 24-20 | ENGR 101 | 30-30 |
| CHEM 1 | 48-30 | CHEM 115** | 60-45 |
| CSCI 1 | 48-20 | CSCI 105 | 45-45 |
| CALC 1 | 48-0 | MATH 103 | 45-15 |
| PHYS 1 | 48-30 | PHYS 103 | 45-45 |
| | | Winter Semester | |
| PHYS 3 | 24-20 | ENGR 141 | 45-0 |
| ENGL 1 | 36-0 | ENGL 100 | 45-0 |
| CALC 2 | 48-0 | MATH 104 | 45-15 |
| LALG 1 | 48-0 | MATH 221 | 45 |
| PHYS 2 | 48-30 | PHYS 104 | 45-45 |
| | | Spring Semester | |
| ENGR 2 | 48-0 | ENGR 102 | 30-30 |
| ENGL 2 | 36-0 | COMC 102 | 45-0 |

Notes

- Courses may run in different semesters.
- COTR is a signatory to the Common First Year Engineering Curriculum agreement (CFYEC) among BC's public post-secondary engineering institutions. However, in some program streams there may be non-standard requirements. Always confirm your course selection with your receiving institution for your chosen engineering stream to ensure seamless transfer.
- **CHEM 101 and CHEM 102 may be taken as an alternative to CHEM 115 for programs that require two semesters of Chemistry.

Institutional Notes

1. **UVic:** This agreement features guaranteed admission into second year of one of the Bachelor of Engineering programs for students who have successfully completed all of the courses in the agreement with *a minimum UVIC GPA of C+ (or UVIC 3.0) and who have no course transferrable to a UVic Engineering program with a grade less than a C*. ENGR 130 (Introduction to Professional Practice) must be completed by all students soon after they begin a UVic Engineering program.
2. **UNBC:** UNBC requires the second half of the standard first-year Chemistry offered in a typical BSc program, so students are advised to complete CHEM 101 and CHEM 102. Guaranteed placement within the Bachelor of Applied Science in Environmental Engineering may be possible for those who meet minimum CGPA requirements and complete the Common First Year Engineering curriculum by April 30th.
3. **UBC-V and UBC-O:** Students completing the full CFYEC will be considered as completing the first-year engineering curriculum at UBC. Admission into second year is not, however, guaranteed, and will be approved based on CGPA and available seats.

4. **TRU:** Applicants who have successfully completed all courses within the CFYEC with a minimum TRU GPA of C+ (or TRU GPA of 2.33) and have no courses applicable for transfer with a grade less than a 'C' will be guaranteed second year standing within the Bachelor of Engineering in Software Engineering at TRU. Students completing the full CFYEC will receive transfer credit for CHEM 1520 – Principles of Chemistry, which is normally scheduled in Year 2 at TRU. Students progressing into the Bachelor of Engineering in Software Engineering at TYRU will be required to successfully complete MATH 1700 (discrete mathematics) and SENG 1210 (Programming for Engineers 2) at the earliest scheduled date for each course at that institution to validate their transfer.
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COURSE GRADE:

Course grades are assigned as follows:

| Grade | A+ | A | A- | B+ | B | B- | C+ | C | C- | D | F |
|----------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Mark | ≥ 90 | 89- | 84- | 79- | 75- | 71- | 67- | 63- | 59- | 54- | < 50 |
| Percent | | 85 | 80 | 76 | 72 | 68 | 64 | 60 | 55 | 50 | |

Students are required to maintain a minimum course grade of C (60%) and an average course grade of C+ in all program courses that contribute to the Engineering certificate.

COURSE DESCRIPTIONS:

ENGR 101- Engineering Design 1

An introduction to the principles of the engineering design process, engineering drawing and CAD tools, project/group dynamics, professional responsibility, and writing and presentation skills. This knowledge will be applied to case studies and practical projects to be undertaken by teams of students.

Prerequisites: Minimum 65% in either MATH 090, MATH 100, Pre-Calculus 12, Principles of Math 12, or equivalent; or any grade in Pre-Calculus 12 and 75% or higher in Calculus 12. Minimum 65% in either PHYS 090, Physics 12, or equivalent. Must be registered in the ENGR program.

Corequisites: PHYS 103, MATH 103, and COMP 105 are required courses, either taken prior or concurrently.

ENGR 102- Engineering Design 2

This course will cover engineering design as applied to larger, more self-directed projects. Students will work in groups, following a structured process to design a system comprising of electrical, mechanical, and software sub-systems. Students will complete one major group project through several milestone stages with associated technical reporting, including a final written report and oral presentation. This course will introduce students to the concepts of sustainability and engineering ethics and apply this knowledge to case studies and lab exercises.

Prerequisites: Minimum of 60% in ENGR 101; Minimum of 60% in MATH 103; Minimum of 60% in COMP 105. MATH 104 and PHYS 104 are required courses, either taken prior or concurrently.

ENGR 141 Engineering Statics and Dynamics

This course includes the topics: vector operations, dot and scalar products, conditions for equilibrium in two- and three-dimensions, free body diagrams, moments about an axis, couples, friction, wedges, screws, trusses, methods of joints, method of sections, shear and moment equations and diagrams, relations between distributed load, shear, and moment, kinematics, rectilinear and curvilinear motion in rectangular, normal, tangential, and cylindrical components, dynamics, Newton's second law, equations of motion in various coordinates, Zeroth law and heat capacity, first law of thermodynamics, heat engines.

Prerequisites: Both MATH 103 and PHYS 103 may be taken previously or concurrently

CHEM 101 Fundamentals of Chemistry 1

This course presents the fundamental principles of chemistry with particular reference to acid-base and redox chemistry, electronic structure of atoms and molecules, properties of liquids, gases, solids and their solutions, phase changes, and thermochemistry. The associated laboratory exercises emphasize proper experimental techniques, data collection and analysis, safety and technical writing skills.

Prerequisites: Either Chemistry 12, CHEM 090, CHEM 100, or equivalent. Either MATH 090, Pre-Calculus 12, Principles of Mathematics 12, or equivalent.

CHEM 102 Fundamentals of Chemistry 2

Together with CHEM 101, CHEM 102 provides a solid foundation in fundamental chemical principles. Topics include equilibrium, thermodynamics, kinetics, electrochemistry, chemistry of the main group elements and the chemistry of organic and biomolecules. The associated laboratory exercises emphasize proper experimental technique, data collection and analysis, safety and technical writing skills.

Prerequisites: CHEM 101 or CHEM 115 or equivalent

CHEM 115 Chemistry for Engineering

This course provides a solid background in chemical principles required for engineering students. Topics include acid-base and redox chemistry, electronic structure of atoms and molecules, properties of liquids, gases, solids and their solutions, phase changes, thermochemistry, thermodynamics, equilibrium, kinetics and electrochemistry. The laboratory exercises emphasize proper experimental techniques, data collection and analysis, safety and technical writing skills.

Prerequisites: Either CHEM 090, Chemistry 12 or equivalent. Either MATH 090, Pre-Calculus 12, Principles of Mathematics 12, or equivalent.

COMC 102 Advanced Professional Communications

This course presents the written and oral communication strategies required in any workplace environment. Students gain practical experience that centers on gathering, summarizing and critically assessing information to produce professional documents. Students will also gain a better understanding on how basic design elements enhance the readability of workplace documents and online communications. This course also focuses on helping students develop speaking skills appropriate to informal and formal presentations and interviews.

Prerequisites: ENGL 100, COMC 101 or COMC 150

CSCI 105 Introduction to Programming in the C and C++ Language

This course is an introduction to computational problem solving and computer programming, with a particular emphasis on applications to engineering problems. It is intended for students with little or no programming background. Students will learn to analyze problems and design algorithms as well as implement their solutions using a high-level programming language such as C++. The programming skills taught in this course are language-agnostic and can be applied to other programming languages as well.

Prerequisites: Minimum 65% in either MATH 090, MATH 100, Pre-Calculus 11 AND Pre-Calculus 12; or Pre-Calculus 12 and a minimum of 75% in Calculus 12 or equivalent. It is recommended that students have programmed in some programming language before.

ENGL 100 English Composition

English 100 focuses on composition strategies for writing across academic disciplines. Over the course of the term, students will develop an awareness of how rhetorical situations affect composition and refine their understanding of the fundamentals of essay writing (and clear communication more broadly), including paragraphing, thesis statements, essay structure, and citation methods. Students will also learn the fundamentals of critical thinking and analysis, persuasive writing techniques (including rhetorical appeals and modes), scholarly research, and academic reading.

Prerequisites: Minimum 65% in English First Peoples 12, ENGL 090, or equivalent (refer to Course Equivalency information on the College Website)

MATH 103 Differential Calculus

This course is intended for students who are pursuing a Bachelor of Science degree. Topics include: functions, limits, continuity, derivatives, their interpretation, differentiation rules, techniques of differentiation, implicit differentiation, inverse functions, exponential functions, logarithms, applications of differentiation such as linear approximations, Newton's method, related rates, analysis of graphs, and optimization, and the Mean Value Theorem.

Prerequisites: Either a minimum of 65% in MATH 090, MATH 100, or Principles 12; or Pre-Calculus 11 AND Pre-Calculus 12 with a minimum of 65%; or Pre-Calculus 12 and a minimum of 75% in Calculus 12.

MATH 104 Integral Calculus

Students work with polynomial, rational, logarithmic, exponential, trigonometric, inverse functions. They will learn integration techniques (substitution, parts, partial fractions, trigonometric substitution, numerical methods), applications of integration (volumes of revolution, work, l'Hôpital's rule and improper integrals; sequences and series; convergence tests (divergence, integral, comparison, limit comparison, ratio, root, and alternating series tests), Power, Maclaurin and Taylor series, and differential equations.

Prerequisites: MATH 103 or equivalent; or a score of 4 or 5 on the AP Calculus.

MATH 221 Elementary Linear Algebra

This course is intended for students who are pursuing a Bachelor of Science with major in Computing, Mathematics or Physics or Applied Science Engineering degree. Topics include: systems of linear equations and matrices, matrix arithmetic, determinants, vectors, products of vectors, lines and planes in 2- and 3-space. Euclidean vector spaces, real vector spaces, inner product spaces, eigenvalues and eigenvectors, diagonalization, linear transformations, kernel, range, similarity, approximation, quadratic forms.

Prerequisites: MATH 104 except students enrolled in first year Engineering. MATH 103 for first year Engineering students (may be taken concurrently).

PHYS 103 Introduction to Physics 1

This course introduces the student to how calculus is used to build physical theory and to solve problems in kinematics, dynamics, momentum, and centre of mass calculations. In addition, the student is introduced to several conservation laws, in particular conservation of mechanical energy and linear and angular momentum.

Prerequisites: Either PHYS 090, Physics 12 or equivalent. MATH 103 is a required course, either taken prior or concurrently.

PHYS 104 Introduction to Physics 2

This course builds on PHYS 103. Electric fields and electric potentials are calculated from a variety of continuous distributions of electric charge using Coulomb's Law and Gauss' Law. The principles of electrostatic equilibrium and dynamic equilibrium in conductors are used to discuss capacitors and resistors, and to calculate the effective capacitance or resistance for circuits. Kirchhoff's loop rules are used to analyze more sophisticated circuits. Magnetic fields are calculated from distributions of electric current using Ampère's law; and the force from a magnetic field on a current carrying wire or moving charge is calculated. Electromotive force is calculated using Faraday's law of induction, and is applied to generators, transformers and inductors. Maxwell's equations are introduced and used to explain electromagnetic waves. Special relativity is introduced.

Prerequisites: PHYS 103; 104 is a required course, either taken prior or concurrently.