COLLEGE OF
THE ROCKIES

Engineering Statics and Dynamics – ENGR 141
University Studies Program

Course Outline

GENERAL COURSE DESCRIPTION:

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.

Program Information: This course is required for students pursuing the Engineering Certificate who want to transfer into Engineering at Universities in British Columbia. It can be used for the Associate of Arts and Science Degrees.

Delivery: This course is delivered face-to-face or hybrid.

COTR Credits: 3

Hours for this course: 45 hours

Typical Structure of Instructional Hours:

Instructional Activity	Duration
Lecture Hours	45
Seminars / Tutorials	
Laboratory / Studio Hours	
Practicum / Field Experience Hours	
Other Contact Hours	
Total	45

Practicum Hours (if applicable):

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

Course Outline Author or Contact:

Trevor Beugeling, MASc, BSc

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Signature

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APPROVAL SIGNATURES:

Department Head
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Department Head Signature

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Dean Signature

EDCO

Valid from: September 2021 – March 2026

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Education Council Approval Date

COURSE PREREQUISITES AND TRANSFER CREDIT:

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

Corequisites: None

Flexible Assessment (FA):

Credit can be awarded for this course 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.

Prior Course Number: PHYS141 and PHYS170: APSC 141
Date Changed: September 2021

Textbooks and Required Resources:

Textbook selection varies by instructor and may change from year to year. At the Course Outline Effective Date, the following textbooks were in use:

> Hibbeler, R.C. *Engineering Mechanics: Static and Dynamics*. 14th ed. Prentice-Hall Publishing Company, 2015.

Please see the instructor's syllabus or check COTR's online text calculator http://go.cotr.bc.ca/tuition/tCalc.asp for a complete list of the currently required textbooks.

LEARNING OUTCOMES:

Upon the successful completion of this course, students will be able to

- apply Newton's Laws in a variety of situations;
- manipulate vectors in two- and three-dimensions: addition, subtraction, and scalar multiplication of vectors; calculate the dot and cross products of vectors; calculate the angle between vectors; break a vector into components;
- use Free Body Diagrams to analyze force systems in two- and three dimensions;
- calculate the moment of a force about a line; find a force and moment which is equivalent to a system of forces and moments;
- draw a Free Body Diagram for a rigid body and solve problems using the equations of equilibrium;
- understand the characteristics of dry friction; solve problems involving frictional forces in wedges and screws;
- determine the forces in the members of a truss using the methods of joints and sections;
- analyze the forces acting on the members of frames composed of pin-connected members;
- apply the method of sections to determine the internal loadings in a member;
- formulate equations which describe the internal stress and moment throughout a member;
- use calculus to analyze the kinematics of a moving particle exhibiting both continuous and erratic motion; the relationship between position, velocity, and acceleration;
- describe curvilinear motion in rectangular and in cylindrical coordinates; understand and apply the normal and tangential components;
- analyze relative motion using a translating axis;
- use Newton's second law to derive the equation of motion for a system of particles;
- perform calculations using the equations of motion in both rectangular and cylindrical coordinates;
- Zeroth law and heat capacity;
- kinetic theory, first law of thermodynamics; and
- heat engines.

COURSE TOPICS:

General Principles:
- Units of Measurement
- Calculations; Significant Figures

Vectors:
- Vector Operations
- Dot Product; Angles Between Vectors; Components

Force Systems:
- Moment of a Force About an Axis; Cross Products
- Principle of Moments
- Simplification of a Force and Couple

Equilibrium of a Rigid Body:
- Free Body Diagrams
- Equations of Equilibrium

Friction:
- Dry Friction
- Wedges and Screws

Structural Analysis:
- Trusses
- Method of Joints
- Method of Sections

Internal Forces:
- Shear and Moment Equations and Diagrams
- Distributed Load, Shear, and Moment

Kinematics:
- Rectilinear Kinematics
- Curvilinear Motion; Normal and Tangential Components
- Projectile Motion
- Cylindrical Coordinates

Force and Acceleration:
- Newton's Second Law
- Equations of Motion:
  - Rectilinear Coordinates
  - Normal and Tangential Coordinates
  - Cylindrical Coordinates

Thermodynamics:
- Zeroth Law and Heat Capacity
- Kinetic Theory, First Law of Thermodynamics
- Heat Engines

See instructor's syllabus for the detailed outline of weekly readings, activities and assignments.

EVALUATION AND ASSESSMENT:

Assignments	% Of Total Grade
Assignments/Quizzes	20%
Midterms	30%
Final Exam	50%
Total	100%

Please see the instructor's syllabus for specific classroom policies related to this course, such as details of evaluation, penalties for late assignments and use of electronic aids.

EXAM POLICY:

Students must attend all required scheduled exams that make up a final grade at the appointed time and place.

Individual instructors may accommodate for illness or personal crisis. Additional accommodation will not be made unless a written request is sent to and approved by the appropriate Department Head prior to the scheduled exam.

Any student who misses a scheduled exam without approval will be given a grade of "0" for the exam.

COURSE GRADE:

Course grades are assigned as follows:

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

A grade of "D" grants credit, but may not be sufficient as a prerequisite for sequential courses.

ACADEMIC POLICIES:

See www.cotr.bc.ca/policies for general college policies related to course activities, including grade appeals, cheating and plagiarism.

COURSE CHANGES:

Information contained in course outlines is correct at the time of publication. Content of the courses is revised on an ongoing basis to ensure relevance to changing educational, employment and marketing needs. The instructor endeavours to provide notice of changes to students as soon as possible. The instructor reserves the right to add or delete material from courses.

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