NORTHWESTERN POLYTECHNIC

DEPARTMENT OF SCIENCE

COURSE OUTLINE – Fall/Winter/Spring 2024

# EG1600 (A3): Introduction to Engineering Profession, Design, and Communication – 2 (1-0-3) 60 Hours for 15 Weeks

Northwestern Polytechnic acknowledges that our campuses are located on Treaty 8 territory, the ancestral and present-day home to many diverse First Nations, Metis, and Inuit people. We are grateful to work, live and learn on the traditional territory of Duncan's First Nation, Horse Lake First Nation and Sturgeon Lake Cree Nation, who are the original caretakers of this land.

We acknowledge the history of this land and we are thankful for the opportunity to walk together in friendship, where we will encourage and promote positive change for present and future generations.


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| **INSTRUCTOR:** | Braden Kelly | **PHONE:** | 780-539-2963 |
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| **OFFICE HOURS:** | TBA | | |


## CALENDAR DESCRIPTION:

Fundamental design process and theory in a multidisciplinary context. Importance, in engineering design, of communications; teamwork; the engineering disciplines, career fields; professional responsibilities of the engineer including elements of ethics, equity, concepts of sustainable development and environmental stewardship, public and worker safety and health considerations including the context of the Alberta Occupational Health and Safety Act.

## PREREQUISITE(S)/COREQUISITE:

Corequisite: EN1990

## REQUIRED TEXT/RESOURCE MATERIALS:

There are no required textbooks.

## DELIVERY MODE(S):

Lecture: Friday 8:30-9:50AM, room J228.

NORTHWESTERN POLYTECHNIC

## LEARNING OUTCOMES:

1. Describe and explain the following: a) the role of the engineering profession; b) an engineers responsibility to society and the protection of the public; c) engineering professionalism and self governance; d) the roles of regulatory bodies (e.g. APEGA, Engineers Canada); e) the professional knowledge, skills, and attitudes of engineers; f) the Engineering Code of Ethics; g) Sustainability and the UN Sustainable Development Goals; h) Workplace (AOHSA) and Product safety; i) Standards, Codes, and Regulations; and j) the impact of engineering projects, products, and solutions on our environment and society.
2. Demonstrate the application of the knowledge described in the above learning outcome (LO1) as ethical and professional behavior while engaging in the team design projects.
3. Describe and distinguish between transdisciplinary teams and multidisciplinary teams. Describe the roles of the different engineering disciplines in multi-disciplinary engineering projects.
4. Provide examples of designs and design products from different engineering disciplines. Recognize what components, sub-systems, and systems of various engineering products are and explain the difference between them.
5. Describe the general design process, stages, and design fundamentals and apply them to an open-ended problem in a term project utilizing the following steps: a) Recognize a need, an opportunity, or a problem and be able to describe it; b) Develop a problem definition including constraints and solution requirements (the solution criteria should include a focus on helping the community); c) Research and describe the problem background (including determining the applicable codes, standards, and regulations); d) Utilize creativity and innovation ideation tools including brainstorming to generate multiple solution ideas (alternatives) and evaluate for the most promising options; e) Develop the most promising options to enable evaluation against the constraints and the solution criteria; f) Apply decision-making strategies to evaluate the solution alternatives and justify the selection of one alternative that best satisfies the requirements and constraints; g) Describe how the proposed solution fulfills and satisfies the given problem specifications, requirements, and constraints in a written project proposal; h) Develop and document the problem solution by producing appropriate written documentation (project notes and log book) and drawings to visualize and explain the selected solution (consideration should be given to applicable codes, standards, and regulations); i) Integrate the project work and present it in a video report describing the problem, need, or opportunity; the solution requirements and constraints; and justify the chosen solution in the video report.
6. Apply the concept of upcycling to design and sketch a small hands-on artifact built from recycled materials. Employ and analyze the effectiveness of a trial and error approach to product design and fabrication. Evaluate the design efforts to learn from failures and successes.
7. Name and describe the function of different forms of graphical communication used in different engineering disciplines (piping and instrumentation diagrams, process

flow diagrams, blueprints, electrical schematics, floor plan, component diagrams, etc).

8. Describe the key principles of effective teamwork and project management. Demonstrate professionalism, ethics, teamwork, leadership, and project management skills, while working on a team design project including: a) project planning execution by utilizing project management tools; b) self reflection practice to identify personal strengths and weaknesses in order to set development goals in an individual and team context (lifelong learning practice development); c) self-management practice, conflict resolution, and leadership skills.
9. Demonstrate engineering communication skills by communicating professionally with teammates and project stakeholders, resolving and/or avoiding conflicts, and by creating the required written documentation (project proposal) and a video report of a term project as per the assignment specifications

## TRANSFERABILITY:

Please consult the Alberta Transfer Guide for more information. You may check to ensure the transferability of this course at the Alberta Transfer Guide main page http://www.transferalberta.alberta.ca.

** Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. **Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability.**

## EVALUATIONS:

| Assessment | Weight | Due Date | Notes |
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| EHS Training (WHMIS) | 5 points | Week 13 | Mandatory to enter 2nd year program |
| EHS Training (ELO) | 5 points | | |
| Proposal Letter (1/group) | 30 points | Week 6 | Project major deliverables; minimum 50% on each to pass course |
| Video Report (1/group) | 35 points | Week 12 | |
| Check in Submissions (log book) | 10 points | Weekly | Project Participation. Self and Team logbook entries. |
| 2 Team-Evaluations | 5 points each | Week 6 & 13 | Team assessment to assess contributions |
| Hands-on Build Trial or Schematic TBD | 5 points | Week 7 & 8 | Hands on experience and creativity |
| **Total** | **100 points** | | **100%** |

NORTHWESTERN POLYTECHNIC

GRADING CRITERIA:

| Alpha Grade | 4-Point Equivalence | Percentage Conversion (unless otherwise specified in the Course Outline) | Descriptor |
|---|---|---|---|
| CR | N/A | 50-100 | Credit |
| NC | N/A | 0-49 | No Credit |

Students must achieve at least 65% overall, have attended > 90% of all lectures and 100% of labs, and achieved at least 50% on each assessment. Students must also receive satisfactory team evaluations.

**Project Problems:** The project topics will be suggested from a list of generic transdisciplinary open-ended problems. Students will have to meet their teammates, select a team leader, choose project topic of group interest, and apply lecture theory to develop a project proposal with a reasonable and effective solution. Then, teams will have to visualize their solution, present and defend it in a short video report. Students can consult with any stakeholders, if needed.

**Project Proposal:** First, students will have to choose their project problem, which will come with background information and a set of the client's general requirements. It will be presented as a mini Request for Proposals (RFP). Using the client's requirements, students will have to develop engineering design requirements, including potential objectives and constraints. They have to summarize their work in a short written proposal (according to the rubric provided). Detailed instructions for each week will be found D2L. Project rubrics will be also available on D2L.

**Project Video Report:** The video report should be no more than 5 mins, preferably 2 to 3 mins. It must present the visualized solution, explain, and defend its efficiency. The video report should be developed according to the rubric provided. Students will need to create a design logbook and take short notes and videos or photos every week to later put them into a video report. It is their responsibility to communicate effectively, manage the time for the project work, negotiate with each other, divide workload, and resolve any conflicts.

**Software Requirements:** MS Office or equivalent, MS Visio or equivalent, Adobe reader and any **free** video maker. Students have a choice of what software they would like to use. It is recommended to use a free video editing software or a free trial of a paid software. If student decides to purchase the software, it is at their discretion only. This course DOES NOT require students to purchase any particular video editing software. If students still choose to purchase a software, some student discounts may be applicable to students in some companies.

**Team-Evaluations:** As part of the course project, each student will evaluate their project teammates' contributions and performance via a team assessment tool (ITP Metrics). There will be 2 team assessments. After each peer evaluation, students will receive anonymous and randomly-ordered scores and comments from their teammates.

NORTHWESTERN POLYTECHNIC

## COURSE SCHEDULE/TENTATIVE TIMELINE:

The following schedule is based on the ENGG 160 schedule at the University of Alberta and may be altered throughout the course as the instructor sees fit.

| Week | Lectures & Corresponding Daily Project Team Activities | Online eClass Activities | Project Work in Groups | Readings to help the project (Not-Mandatory) McCahan e-book: |
|---|---|---|---|---|
| 1 | Course Introduction | Design & Program Videos Open<br>Workplace Safety Introduction, WHIMIS, ELO Trainings Open | Download all project files<br>Read Project Instructions<br>Project Instructions 1<br>Check team assignment, contact teammates, Choose the team leader, Look at Project Topics (RFPs) | Working in Teams & Managing them: 219-223, 225-229, 237-239, 240-245 |
| 2 | Introduction to Engineering Design<br>Team role assignment & picking a project | Readings: Introduction to Communication and Engineering Design | Project Instructions 2<br>Team Meeting<br>**Team roles and project selection submission** | Engineering Design & Planning: 1-26, 230-235, 247-251<br>Engineering Communication: 318-340 |
| 3 | Planning Stage (Problem Definition, Requirements)<br>Project Management<br>Team: Problem Definition, listing requirements | Reading: Introduction to Project Management and Planning<br>Research Tools<br>Project Management Tools | Project Instructions 3<br>Project Management Decisions<br>**Submit the preliminary problem definition and requirements for the selected project** | Design Process: 35-41, 50-53, 56-59, 83-88<br>Project Management: 261-282 |
| 4 | Concept Development 1: Idea Generation<br>Team: Brainstorming session | Reading: Introduction to Liability, Risk, Safety, Codes and Standards<br>Standards Example | Project Instructions 4<br>**Submit results of the Brainstorming Session** (min. 3 different alternatives) | Design Tools: 104-105, 108-111, 115-119, 122-123,<br>Idea generation:125, 128-132, 134-137<br>Safety: 475-478<br>Failure & Risk: 550-569 |

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| 5 | Concept Development 2: Idea Selection, Decision-Making<br><br>Team: Decision-making process and iteration of concept | Reading: Introduction to Engineering Ethics | Project Instructions 5<br><br>**Submit the decision-making process notes** | Idea Evaluation & Decision-Making: 144-148, 150-151, 160-162, 185-187, 189-190, 197-199, 202-203<br><br>Iterations: 163-176 |
| 6 | System-Level and Detailed Design<br><br>Design in Different Disciplines<br><br>Team: Identification of project aspects that fall under different disciplines | Reading: Introduction to Sustainability | Project Instructions 6<br><br>**Team Evaluation 1**<br><br>**PROJECT PROPOSAL DUE** | Design for Environment & Sustainability: 365-367, 396-399 |
| *Reading Week* | | | | |
| 7 | Hands-on Build Competition in class: Teams showcase to their TAs their deliverables | Life-Long Learning Video | Project Instruction 7<br><br>Visualization of the Proposed solution | |
| 8 | Hands-on competition Bonus Round: Top 5 teams of each section showcase their design | Real-life Industrial Practice Video | Project Instruction 7<br><br>**Submit Team Ranking for Hands-on** | |
| 9 | Introduction to Graphics & Technical Communication in various Disciplines<br><br>Team: Sketching the solution, working on the visual representation | *Additionally:* Tips on Visual Communication, Sketching, Presentations | Project Instruction 7<br><br>**Submit Sketches** | Intellectual Property: 438-452 |
| 10 | Implementation & Testing Stage<br><br>Design Project End – Part 1 Design iteration<br><br>Team: Design Iteration activity and Improvement | All Design & Program Videos must be completed | Project Instructions 8<br><br>**Submit scripts for the Video Report** | Manufacturing: 460-474 |

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| 11 | Production Stage<br>Design Project End – Part 2 Design iteration<br>Team: Project feasibility assessment activity | 2nd -year PROGRAM SELECTION | Project Instructions 8<br>**Submit feasibility assessment and iterations notes** | |
| 12 | Design Project End – Part 3 Design iteration<br>Team: SWOT analysis of the course activity | | Project Instructions 9<br>**Submit the SWOT analysis of the course activity**<br>**VIDEO REPORT IS DUE** | |
| 13 | Role of the Engineering Professional body: APEGA<br>Whole class: watching video reports | WHIMIS and ELO Trainings DUE | **Team Evaluation 2** | |

STUDENT RESPONSIBILITIES:

Much of the course content will be structured around the term project, which requires students to apply the knowledge from online material and in-class lectures. The project will focus a lot on the first 2 stages of the design process that students will learn in class – Planning (Problem Definition) & Concept Development. It also requires basic analysis, creative and innovative approach, and utilization an appropriate forum such as makerspace/engineering garage, where they can experiment and prototype. Students are expected to work in groups of 6-7 people and recognize the importance of teamwork. They will apply the knowledge from online material and in-class lectures to define, plan and develop their projects.

STATEMENT ON ACADEMIC MISCONDUCT:

Academic Misconduct will not be tolerated. For a more precise definition of academic misconduct and its consequences, refer to the Student Rights and Responsibilities policy available at https://www.nwpolytech.ca/about/administration/policies/index.html.

**Note: all Academic and Administrative policies are available on the same page.

## Additional Information (Optional):

Engineers Rule The World (ERTW).