CHBE 573: Environmental Engineering and Sustainability

(Proposed title: Engineering and Sustainability Leadership)

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Course Narrative:
This course explores the gap between engineering solutions and societal change (adaptation/embracement) in creating a more sustainable future. Technological advancements can positively impact society, but we often need to understand and define the problem differently to better foster the necessary societal changes to ensure that these technological solutions are part of a more sustainable future. What are the assumptions about how the world operates and how people and societies behave? What does it mean to be a member of society wanting to contribute to a more sustainable future? Through leadership training, on-campus community-based learning, and using a framework for sustainable practices, students will develop their own approach and capabilities in contributing to and envisioning a more sustainable future.

Course Learning Goals:
By the end of the course, students will be able to demonstrate competence in the following goals that are divided into three categories.
1. Reframing engineering problem/solutions from a more holistic perspective:
    - Establish connections between one's own discipline and sustainable development goals through systems thinking
    - Demonstrate the ability to integrate knowledge of social and ecological systems to predict or forecast, assess, analyze and integrate the effects of human activities
    - Examine aspects of Indigenous knowledge in understanding our interactions with nature
2. Cultivate your capacity to envision and create sustainable solutions
    - Create a personal vision for the changes one intends through understanding one's leadership purpose/style
    - Engage in self-assessment, self-reflection, and analysis and cultivate a strong awareness of one's own values and how they inform one's perspectives
    - Develop leadership skills, including communication, collaboration, mediation and consensus building strategies, to advocate for positive changes, and demonstrate empathy for others and the ability to weigh multiple perspectives
3. Developing and implementing a sustainable solution
    - Apply the methodology of design thinking to innovate solutions and assess impact of a SEEDS (Social Ecological Economic Development Studies) project
    - Practice adaptive leadership through identifying attitudes, values and behaviours that require shifting in affecting change

Potential Topics: (select topics are covered each year)
- Sustainability
    - Mental models
        - Become aware of our deeply engrained assumptions which lead to how we interpret the systems around us (personal stance)
        - Develop structural knowledge of problems appropriate to sustainability (transdisciplinary) inquiry
    - Systems thinking
        - Discover interconnectedness and complexity
        - Analyze using causal loop diagram and/or stock and flow models
        - Leverage intervention in a system
        - Develop skills of systems thinking in environmental issues

        - Identify incentives that perpetuate an unsustainable system
        - Recognize unintended consequences
    - Concept mapping
        - Identify concepts; establish relationship; denote structure
        - Structure learning through connection to prior knowledge
    - Industrial Ecology/circular economy as framework for assessment
        - Acquire knowledge of input-output methods; material flow analysis; ecological footprint; and life-cycle assessment as environmental systems analysis tools
    - Environmental literacy
        - Assess information and source critically
    - Environmental engineering
        - Explore the role and its profession
        - Assess the skills and "tools of the trade"
    - Understanding the landscape for changes
        - Develop personal goals of being the agent of change
        - Analyze components and evolution of social transformation
    - Reciprocity
        - Value Indigenous teachings of reciprocity
        - Examine one's act of reciprocity with the world
    - Well-being
        - Assess components contributing to well-being of community
        - Frame happiness as one measure of well-being
        - Establish connections between happiness and wellness
    - Imagination
        - Explore ways of tapping into imagining a world we want
        - Exercise backcasting from the imagined future
        - Understand seven generations teaching and its practice
- Leadership skills
    - Integrity
        - Conduct oneself with integrity – keeping and honouring words
        - Experience unworkability of a team without integrity
    - Authentic listening
        - Practice authentic listening to experience the whole person in context
        - Develop as a skill to cultivate empathy
        - Discover the art of powerful questions
    - Perspective taking
        - Apply and develop perspective taking techniques
        - Develop historical (discipline specific) understanding
    - Power of context
        - Discover the power of context
        - Examine leadership as creating context for others
    - Mentorship/coaching
        - Develop framework on novice to expert continuum
        - Practice and acquire skills to facilitate reflection and learning
    - Adaptive leadership
        - Distinguish between classic leadership role models
        - Embrace ambiguity and cope effectively with change
        - Explore human change dynamics
- Professional development
    - Reflective practitioner
        - Develop skills to practice reflective dialogue as means of facilitating and deepening the levels of learning

        - Compare different levels of reflective practices
        - Identify mechanism to learn from failure
    - Ethical framework
        - Promote moral reasoning and development
        - Practice ethical responsibility, toward present and future generations
        - Develop framework on environmental justice
    - Political framework
        - Develop political efficacy to think and act civically and politically
        - Understand how policy process works, and how it can instigate change in society
    - Communication
        - Communicate effectively with people from diverse perspectives, and facilitate collaborative dialogue
        - Develop skills to advocate for positive change and build consensus
        - Practice objections handling and language of commitment
        - Articulate shared vision
    - Design thinking
        - Apply process of design thinking in driving innovation and creative thinking towards SEEDS project
        - Practice divergent thinking; work with assholes in a team
    - Experiential learning
        - Experience first person vs. third person learning
        - Facilitate learning for others
    - Restorative justice
        - Experience restorative justice as a tool for healing

Course Assessment:

- Personal Leadership Log & Paper (25%)
    - Over the course of the term, students are asked to keep a reflective journal on (entries every two weeks):
        - Own thoughts about their leadership style
        - Critical assessment of different leadership frameworks
        - Own sense of place and positionality
        - What sustainability means to oneself
        - Some basic beliefs and assumptions of self
        - Shifts that happened during the course
        - Implication of the personal changes
        - Learning journey
    - A final term paper summarizing this leadership reflection highlighting their most significant shifts in their thinking processes is required.

- Assignment (Readiness Assurance Quiz (RAQ) creation) and midterm exam (20%)

- SEEDS Group Project (25%)
    - Each student team will be given a SEEDS project (on-campus project) related to affecting change related to sustainability on campus. This will include the application of design thinking to create and iteratively come up with optimized solutions, which then will be assessed for impact.
    - Deliverables for the project are set between the team and its client. The iterated proposal, mid-term reflections, final report and presentation are required.

- Class Facilitation (15%)

- Students working in pairs will choose a topic (from the list above) to facilitate an in-class discussion. Prior to facilitation, students will assign reading and/or viewing material to the class, and set learning objectives.
- Facilitate class learning through applying active learning pedagogy. The length is normally for 45 min with exceptions upon request.
- Class will give feedback and assessment to facilitators, after each facilitation.
- Class Facilitation Journal entry to be completed after the facilitation. Entry should include topic and learning objectives, summary of and reasons for the assigned reading/viewing, relevance of topic, and reflection on facilitation, including your assessment on how well you were able to achieve the learning objectives.

- Participation and contributions to discussions (15%)
  - In-person or online synchronous discussions
  - Online blog commenting
  - Engagement and contributions to the learning journey of peers through teamwork and giving feedback