January 2022

University of Manitoba
Price Faculty of Engineering

We're teaching this course on Treaty 1 territory on the lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples and Homeland of the Métis Nation. The clean water that runs through our taps comes from the waters of Shoal Lake 40 First Nation in Treaty 3 Territory; the electricity that powers our computers, lights, and car is generated in the waters in Treaty 5 territory. We privilege from Indigenous Peoples' resources and lands. We are dedicated to learning and teaching the truth about Indigenous Peoples in Manitoba and Canada, their cultures, their histories and their present, and working to reconcile these truths to find a better way forward.

Course Details

Course Title & Number:	**ENG 4100 Contemporary Topics in Engineering Practice: Decolonizing and Indigenizing Engineering**
Class Times & Days of Week:	Classes: T/TH 1:00-2:20 Tutorial: Asynchronous
Location for classes/labs/tutorials:	Virtual until TBA (Zoom)
Pre-Requisites:	ENG 1430 Design in Engineering

Course Description:

This Special Topics course, *ENG 4100 Contemporary Topics in Engineering Practice: Decolonizing and Indigenizing Engineering*, will engage students to critically reflect on current perspectives and practices in decolonizing and Indigenizing the profession of engineering. An important goal of decolonizing is not only the recognition and undoing of colonialism but also critical reflection on Western ideologies and knowledge systems. Indigenization of the engineering profession will result in the inclusion and integration of Indigenous knowledges, cultures, thought, approaches and perspectives into the engineering field.

Students will critically analyze a variety of topics encompassing both the decolonization and Indigenization of engineering. Students will develop their lifelong learning skills (critical reflection) in critically examining the impact of engineering on society and the environment, ethics & equity, and economics & project management in engineering via a decolonial lens. They will use their technical communication skills (reading, writing, dialoging, and presenting) to demonstrate their learning. This course will provide students with knowledge for working successfully with First Nation, Métis and Inuit communities on engineering projects, with emphasis on engineering in Manitoba.

This Special Topics course (ENG 4100) covers contemporary topics relating to the practice of professional engineering. As the course content will vary from year to year, students may take different ENG 4100 courses more than once for credit. *ENG 4100 Contemporary Topics in Engineering Practice: Decolonizing and Indigenizing Engineering* is available to all students who have received credit for ENG 1430.

Instructor Information

Instructor(s) Name:	Randy Herrmann, Métis P.Eng., Director of ENGAP, (he/him)
Office Location:	E2-442 EITC
Office Hours:	2:30–3:30 pm T/TH, or by appointment (virtual until back in person)
Office Phone No.	204-474-8547
Email:	Randy.Herrmann@umanitoba.ca
Instructor(s) Name:	Dr. Jillian Seniuk Cicek, Centre for Engineering Professional Practice & Engineering Education, white, settler woman (she/her)
Office Location:	333 Stanley Pauley Engineering Building
Office Hours:	2:30–3:30 pm T/TH, or by appointment (virtual until back in person)
Office Phone No.	204-474-9698 (email is preferred until we are back in person)
Email:	Jillian.SeniukCicek@umanitoba.ca
Teaching Assistant:	
Email:	

Readings, Course Materials

Readings – A set of course readings will be made available through the UM Learn site for this course. Students are responsible for the content covered in these readings in advance of the class on which specific readings are due.
Films/Websites – Links to films/websites for the Tutorials are provided in UM Learn. We recommend keeping up with the tutorials weekly (plans for 2 hours per week).
4 Seasons of Reconciliation – 4 Seasons of Reconciliation is a multi-media teaching unit that promotes a renewed relationship between Indigenous Peoples and Canadians, through transformative multi-media learning. This educational initiative, developed for secondary, post-secondary and the workplace, incorporates teacher guides, slideshows, videos and films along with engaging online portals. It comprises of approximately 10 modules totaling approximately 3 hours and 15 minutes in length. Students are expected to complete 4 Season of Reconciliation during the term and will be provided the link. We have allocated tutorial time for this.

General Course Information

Decolonization – the undoing of colonialism – and Indigenization – the inclusion of Indigenous Peoples and their ways of being, knowing, relating, and doing – are two important topics that are being discussed in social, political, economic, and cultural contexts across Canada and around the world as society grapples with the harms done/being done to Indigenous Peoples and communities, and works toward better ways forward. This has led to the United Nations Declaration on the Rights of Indigenous People (UNDRIP), which Canada endorsed without qualification in 2016, and the introduction of Bill C-15, the *United Nations Declaration on the Rights of Indigenous Peoples Act,* which received Royal Assent on June 21, 2021. It has also led to the Truth and Reconciliation Calls to Action, which include Education and Business for Reconciliation (TRCC, 2021), and have spurred reconciliation efforts in post-secondary education and the engineering profession. Engineers have a professional responsibility to seek the truth and commit to and lead efforts in reconciliation in engineering practice.

This course introduces engineering students to a variety of topics relevant to the decolonization and Indigenization of the engineering profession. Topics will include protocols and working effectively with Elders and Traditional Knowledge Keepers, history of Indigenous Peoples in Manitoba, Treaties, Land Acknowledgments, decolonizing engineering, traditional Indigenous technologies, community engagement, ecology (vs. sustainability), extractive industries, sovereignty, and water. Indigenous pedagogies and ways of knowing will be coalesced with Western approaches in the delivery of the course. Students will participate in sharing circles and learn about the use of story in community, and how kinship and relationships guide how a community owns a story.

Among a variety of forms of knowledge, this course will draw on the knowledges and experiences of guest lecturers (instructors, specialists, Knowledge Keepers, and Elders), who will present both in-person as well as via a video platform. Students will be required to complete weekly readings and/or viewings of journal articles, news reports, documentaries, and films, and will have the opportunity to critically reflect on, discuss, and write about these topics.

Students will be responsible for completing a small writing/oral assignment each week critically reflecting on the lectures, guest presentations, readings and viewings and their connection and relevance to engineering. The final project will be a research report on a topic that critically connects engineering to Indigenous Peoples, communities and/or ways of being, knowing, relating and doing that students have chosen and has been approved by the instructors. Research should include grey and academic literature and/or interviews with Indigenous stakeholders and/or engineers. Students will present their research projects during the last week of classes**.**

Engineering is a pragmatic discipline, embedded in problem solving (Foster and Jordan 2014). The inclusion of Indigenous perspectives, philosophies, and knowledges will enhance engineering problem solving, and benefit engineering education and practice (O'Sullivan 2019). Together, Indigenous Knowledges and Western knowledge should reside alongside engineering knowledge; all have a place in engineering education (Kennedy et al. 2016).

How does this course fit into the curriculum?

This course fulfills a complimentary studies (CS) elective, and the Indigenous requirement for all engineering departments.

Course Goals

The intent of this course is:

- To introduce students to *United Nations Declaration on the Rights of Indigenous Peoples* and the Truth and Reconciliation Commission of Canada *Calls to Action*.
- To engage students to critically reflect on current perspectives and practices in decolonizing and Indigenizing the profession of engineering regarding working effectively with Elders and Traditional Knowledge Keepers, history of Indigenous Peoples in Manitoba, Treaties, Land Acknowledgments, decolonizing engineering, traditional Indigenous technologies, community engagement, ecology (vs. sustainability), extractive industries, sovereignty, and water.
- To engage students to critically reflect on Western ideologies and knowledge systems in engineering and make space for Indigenous worldviews.
- To provide students with knowledge for working successfully with First Nation, Métis and Inuit communities on engineering projects, with emphasis on engineering in Manitoba.

Intended Learning Outcomes

At the conclusion of the course, the student should be able to:

1. Understand how the *United Nations Declaration on the Rights of Indigenous Peoples* and the Truth and Reconciliation Commission of Canada *Calls to Action* are significant to engineering.
2. Critically examine similarities and differences between western and Indigenous ways of knowing, being, relating and doing in engineering, and recognize the importance of making equitable space for both.
3. Critically examine and reflect on the impact of engineering on society and the environment, ethics & equity, and economics & project management in engineering considering Indigenous and decolonial perspectives.
4. Demonstrate knowledge for working successfully with First Nation, Métis and Inuit communities on engineering projects, with emphasis on engineering in Manitoba.

Expected Level of Development in Course **

Learning Outcome	Attribute*											
	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1							D/A		D/A	D/A	D/A	D/A
2							D/A		D/A	D/A	D/A	D/A
3							D/A		D/A	D/A	D/A	D/A
4							D/A		D/A	D/A	D/A	D/A

***Attributes*:**
KB A knowledge base for engineering
PA Problem analysis
IN Investigation
DE Design
ET Use of engineering tools
IT Individual and teamwork
CS Communication skills
PR Professionalism
IE Impact of engineering on society/ environment
EE Ethics and equity
EP Economics and project management
LL Life-long learning

**Expected Level of Development:
I – Introductory
D – Intermediate
A – Advanced

Course Outline

WEEK 1
Tuesday Jan 25th (Class 1) – Course Introduction (syllabus, assessments, dialogue & discourse)
Thursday Jan 27th (Class 2) – Opening the course in a good way & Tobacco Teaching – Elder Norman Meade

- TUTORIAL (Asynchronous) – *Braiding Ways of Knowing* – Reconciling Ways of Knowing Forum with Robin Wall Kimmerer (1.5 hours) (public)

WEEK 2
Tuesday Feb 1st (Class 3) – Understanding Worldview Differences – Jessica Vandenberghe
Thursday Feb 3rd (Class 4) – Our Path to Reconciliation – Valerie Williams & Vanessa Lillie

- TUTORIAL (Asynchronous) – *Creating Ethical Space Towards Decolonizing Engineering and STEM Education* – Panel Discussion with Deanna Burgart & Kerry Black with Matthew Oliver, Kaella-Marie Earle, and Carol Crowe (with permission)

WEEK 3
Tuesday Feb 8th (Class 5) – Treaties and Residential Schools – NCTR presentation
Thursday Feb 10th (Class 6) – Indigenous Technology – Randy Herrmann

- TUTORIAL (Asynchronous) – *Why Reconciling Ways of Knowing?* – Reconciling Ways of Knowing Forum with Miles Richardson, O.C.; Dr. David Suzuki; Dr. Nancy Turner; and the late Elder Dr. Dave Courchene, Jr., (2 hours) (public)

WEEK 4
Tuesday Feb 15th (Class 7) – Engineers Role in Decolonization – Randy Herrmann
Thursday Feb 17th (Class 8) – Land Acknowledgements – Randy Herrmann

- TUTORIAL (Asynchronous) – *4 Seasons for Reconciliation (licensed through University of Manitoba until March 31, 2022 (two tutorials)*

WEEK 5
Winter Term Break: February 22 – 25

WEEK 6
Tuesday March 1st (Class 9) – *Indigineering: Engineering Through Indigenous Knowledge and Mino Pimachisowin* – John Desjarlais
Thursday March 3rd (Class 10) – UNDRIP, UN Sustainable Goals & Engineer Grand Challenges – Randy Herrmann

- TUTORIAL (Asynchronous) – TUTORIAL (Asynchronous) – *4 Seasons for Reconciliation (licensed through University of Manitoba until March 31, 2022 (two tutorials)*

WEEK 7
Tuesday March 8th (Class 11) – Community Collaboration – Nicki Ferland
Thursday March 10th (Class 12) – Engineering & Community Collaboration: Doing engineering work in Indigenous Communities – Linda Murphy

- TUTORIAL (Asynchronous) – Complete *Working in Good Ways Practitioner Workbook* – Anny Chen, Gera Villagrán, and Nicki Ferland, Community Engaged Learning, University of Manitoba (public)

WEEK 8
Tuesday March 15th (Class 13) – Water Teaching – Elder Mae Campbell
Thursday March 17th (Class 14) – Wahkohtowin: The Interconnectedness of Design and Engineering – James Harper

- TUTORIAL (Asynchronous) – *The Role of Engineers in Decolonization and Reconciliation* – John Desjarlais and Pam Wolf – Truth and the Role of Engineers in Decolonization, UBC Applied Science (public)
- TUTORIAL (Asynchronous) – *Indigenous Ways of Knowing* – Elder Albert Marshall & Curtis Rattray – Truth and the Role of Engineers in Decolonization, UBC Applied Science (public)

WEEK 9
Tuesday March 22nd (Class 15) – Food Sovereignty – Dr. Shirley Thompson
Thursday March 24th (Class 16) – Indigenous Housing – Dr. Alex Wilson

- TUTORIAL (Asynchronous) – *Indigenization in the Time of Pipelines* – Chelsea Vowel, Weweni Indigenous Scholars Speaker Series (public)

WEEK 10
Tuesday March 29th (Class 17) – Manitoba Hydro & Northern Impact – Dr. Peter Kulchyski
Thursday March 31st (Class 18) – Manitoba Hydro Current Context – Jeffrey Betker

- TUTORIAL (Asynchronous) – *Land Acknowledgements for Engineers and Geoscientists* (EGBC) – Chief Leah George-Wilson, Linda Murphy, Nalaine Morin, and Matthew Dunn (with membership, free to join; create an account – there's no cost. Let us know if you need help.)

WEEK 11
Tuesday April 5th (Class 19) – "Indigenous Peoples and Settler Peoples: Immiscible Worldviews" – Matthew Oliver
Thursday April 7th (Class 20) – Shoal Lake 40 First Nation and the Winnipeg Aqueduct – Roxanne Balan & Chelsea Dubiel

- TUTORIAL (Asynchronous) – *Douglas Cardinal: Architect of the Future: Film Screening and Conversation* with [redacted] (with permission)

WEEK 12
Tuesday April 12th (Class 21) – Incorporating Indigenous Design into Buildings –Elder Carl Stone
Thursday April 14th (Class 22) – Decolonizing Design – Shawn Bailey

- TUTORIAL (Asynchronous) – *Indigenous Practitioner Perspectives on City Building* – Canadian Urban Institute (public)

WEEK 13
Tuesday April 19th (Class 23) – Student Presentations
Thursday April 21st (Class 24) – Student Presentations

Course Assessment Methods

Assignments	**Evaluation Percentage**
4 Seasons for Reconciliation	**Certificate of Completion – Required for ENG 4100 course completion**
Class Participation: assessed by level of active, engaged participation in class, which looks like: thoughtful responses and dialogue as well as active listening and sharing of time with others during class; timely completion of homework.	**25%**
Weekly Critical Reflections: critical reflection on lectures, guest presentations, readings and viewings are **due every Monday by 4 pm (upload to UM Learn)**	**60% (12 x 5% each)**
Summative Critical Reflections presentation: students will present a summative critical reflection (poster, presentation, other?) on their learnings **on April 19th & 21st.**	**15%**
TOTAL	**100%**

Assignment Descriptions

4 Seasons for Reconciliation (Required for ENG 4100 course completion): We will be giving you the details for accessing the modules for this online course at the beginning of the term. (See Course Materials for description of this online course.) Please upload your copy of completion on UM Learn in the specified Assignments folder.

Weekly critical reflections (written/oral or other?) (60%): Students will be responsible for completing a small writing/oral (or other) assignment each week (12 assignments x 5%), critically reflecting on the lectures, guest presentations, class dialogues, readings and viewings and their connection and relevance to engineering. Students may choose to upload a written response or a recording of their oral response (or other?) in UM Learn. Written reflections should be approximately one page, and oral recordings should be approximately 5 minutes. Assignments will be assessed for EE, IE, EP, & LL using the rubric provided in UM Learn. **They are due every Monday by 4 pm (uploaded to UM Learn)**

Poster Presentation (or other?) (15%): Students will present a summative critical reflection on their learnings in the course during the last week of classes. We will discuss this further. **Presentations will be given April 19th and 21st, during the last week of class.**

Class Participation (25%): assessed by level of active, engaged participation in class, which looks like: thoughtful responses and dialogue as well as active listening and sharing of time with others during class; timely completion of homework. (If we are online, and you cannot have your camera on, messages in the chat will be considered participation. Check in with us here and there through the class!)

Assignment Extension and Late Submission Policy

Deadlines are a reality in the world of engineering; we expect assignments to be completed on time. However, there are also situations where deadlines must be negotiated. Please speak with Randy and Jill BEFORE assignments are due to re-negotiate a deadline that you cannot meet. Assignments submitted after the agreed upon due date without prior notice will be docked 10% per day. **All assignments must be submitted to pass the course.**

Grading Scale

The grading scale used for this course is shown below.

Letter Grade	Percentage out of 100
A+	92-100
A	85-91
B+	78-84
B	72-77
C+	66-71
C	60-65
D	50-59
F	Less than 50

Important Dates

Feb 22 - 25:	Winter Term Break
Apr 25:	VW Date for Winter 2022 courses
Apr 25:	Last instructional day for Winter 2022 courses

UNIVERSITY & COURSE POLICIES

Using Copyrighted Material

Please respect copyright. We will use copyrighted content in this course. The content used is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by us, are made available for private study and research and must not be distributed in any format without permission.

Recording Classes & Presentations

Randy Herrmann and Dr. Jillian Seniuk Cicek and the University of Manitoba hold copyright over the course materials, presentations and lectures that form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from Randy Herrmann and Dr. Jillian Seniuk Cicek. Course materials (both paper and digital) are for the participant's private study and research.

Randy Herrmann and Jillian Seniuk Cicek will be recording classes and filming some classes to archive the course for future offerings, and to make a documentary of the course. **Please let us know if you do not want to be recorded or filmed, and we will ensure your voice and image is removed from the archives and documentary film.**

Course Technology – Cameras & Microphones

The course will be delivered using Zoom. Students will be asked **to use their computer cameras and microphones** to engage in classes. If this isn't possible, please let us know, and please use the chat. This course is designed to be a safe place to engage in thoughtful dialogue, critical thinking, and active listening on current perspectives and practices in decolonizing and Indigenizing the profession of engineering. We commit to building a safe learning community with you that you can all trust, where we will support and gently guide your learning. To build this community, we ask you to leave your cameras if you are able on throughout the class, so that we can all see one another, and build respect for and trust in each other. Again, if you cannot leave your camera on, please engage with the chat.

Students who have constraints with technology, or concerns with using their cameras, should speak with Randy and Jill. Students who have technical difficulties should consider consulting IST:

Information Services and Technology
123 Fletcher Argue
University of Manitoba, Winnipeg, MB R3T 2N2 Canada
Office: 204-474-8600 Fax: 204-474-7983
Servicedesk@umanitoba.ca

UM Learn will be central for content, assignments and communication.

As a courtesy to both the instructors and your classmates, please try to avoid distractions as much as possible during class time. Please remember to have your mic on mute unless you are speaking to avoid disruptions.

Class Communication

The University requires all students to activate an official University email account. For full details of the Electronic Communication with Students please visit:
http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy_-_2014_06_05.pdf

Please note that all communication between you as a student and your instructors/TAs must comply with the electronic communication with student policy (http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html). You are required to obtain and use your U of M email account for all communication between yourself and the university.

Academic Integrity

Plagiarism or any other form of cheating on academic work is subject to serious academic penalty. Cheating may take the form of copying from another student, getting help from someone with individual assignments, or claiming another's work as your own. A student found guilty of, and/or contributing to plagiarism or cheating on academic work is subject to serious academic penalty. Students should acquaint themselves with the University's policy on plagiarism, cheating, exam impersonation and duplicate submission. Electronic detection tools may be used to screen assignments in cases of suspected plagiarism. Please refer to the "Academic Integrity" section of the University of Manitoba Undergraduate Academic Calendar. (http://crscalprod.ad.umanitoba.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=341&chapterid=4295&loaduseredits=False).

Referencing Style

Students are expected to follow the APA citation style when citing references in course assignments. Please refer to the Purdue Online Writing Lab for APA guidelines here: https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_style_introduction.html

Expectations: You Can Expect Us To

Learning is most effective when both the instructor and the student are engaged in the subject material. The role of the instructor, therefore, is to create a safe and respectful environment that facilitates student engagement and learning. In this course, some dissemination of information will occur via presentations. However, a substantial portion of the content will be distributed as reading or viewing materials, which will be covered using classroom dialogues and the course assessment activities. You can expect us to endeavour to create a safe, respectful and active learning environment.

Expectations: We Expect You To

We expect you to be in attendance, and on time, for all scheduled classes. If you must be absent, please show us the courtesy of sending an e-mail notifying us of your absence.

To benefit the most from this class, you must be willing to participate in class dialogues. Therefore, we expect you to prepare for class by reading/viewing the assigned materials, leaving your camera on during class, and actively engaging in course discussions via engaged listening and speaking when it's your turn.

Adhere to our Classroom Philosophy:

- Respect others' right to hold opinions and beliefs that differ from your own. Be open to hearing their perspectives. Be open to changing your perspectives based on what you learn from others. Be okay with being uncomfortable and with respectful disagreement.
- Take care when generalizing about groups of people, whether you belong to that group or not. Consider who might feel excluded or devalued when you offer a broad characterization of a diverse group. **Speak from your position alone; do not speak for others**.
- Understand that your words have effects on others. **Speak with care**. If you learn that something you said was experienced as disrespectful or marginalizing, listen carefully and try to understand that perspective. Apologize. Learn how you can do better in the future.
- Be aware of microaggressions (or we'll help each other become aware of them).
- A huge amount of communication is in body language; negative body language is a microaggression (i.e., the rolling of eyes, crossing your arms, leaning away, sighing). Be conscious of your body language and use respectful communication.
- We all make mistakes. Keep an open, and good heart, be humble, be kind, say sorry, and learn how to forgive; this will create a safe and respectful space for everyone.
- Racism will not be tolerated.

Student Accessibility Services

Student Accessibility Services
If you have a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g., mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services http://umanitoba.ca/student/saa/accessibility/
520 University Centre
204 474 7423
Student_accessibility@umanitoba.ca

Student Supports, Services & Resources
We have also uploaded two documents on **UM Learn** for you under **Content >> Students Supports & Services** with supports, resources, and services. If there is anything you cannot find or still need, please reach out to us.

Supplemental Course Information

All courses in the Price Faculty of Engineering program are expected to contribute, in some way, to the development of one or more of the 12 graduate attributes that have been identified by the Canadian Engineering Accreditation Board (CEAB). While there are likely some aspects of many of these attributes that can be found in this course, the graduate attributes being emphasized in this course are: *7) Communication skills,* 9*) Impact of Engineering on Society & the Environment, 10) Ethics & Equity, 11) Economics & Project Management, and 12) Lifelong Learning.*

The 12 graduate attributes have been defined below for your information.

Graduate Attributes

1. **A Knowledge Base for Engineering:** Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.
2. **Problem Analysis:** An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.
3. **Investigation:** An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.
4. **Design:** An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.
5. **Use of Engineering Tools:** An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.
6. **Individual and Team Work:** An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
7. **Communication Skills:** An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
8. **Professionalism:** An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.
9. **Impact of Engineering on Society and the Environment:** An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.
10. **Ethics and Equity:** An ability to apply professional ethics, accountability, and equity.
11. **Economics and Project Management:** An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.
12. **Life-long Learning:** An ability to identify and address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.