CEAB Graduate Attribute Assessment at Ryerson University

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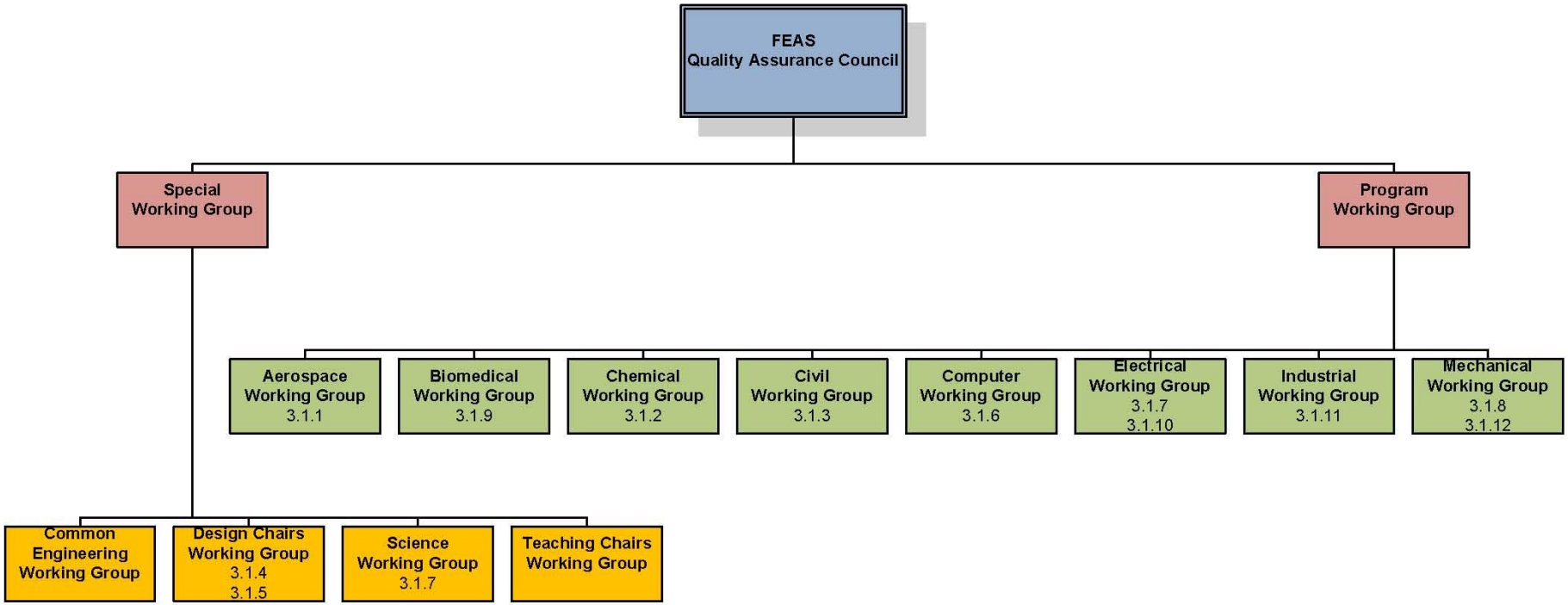
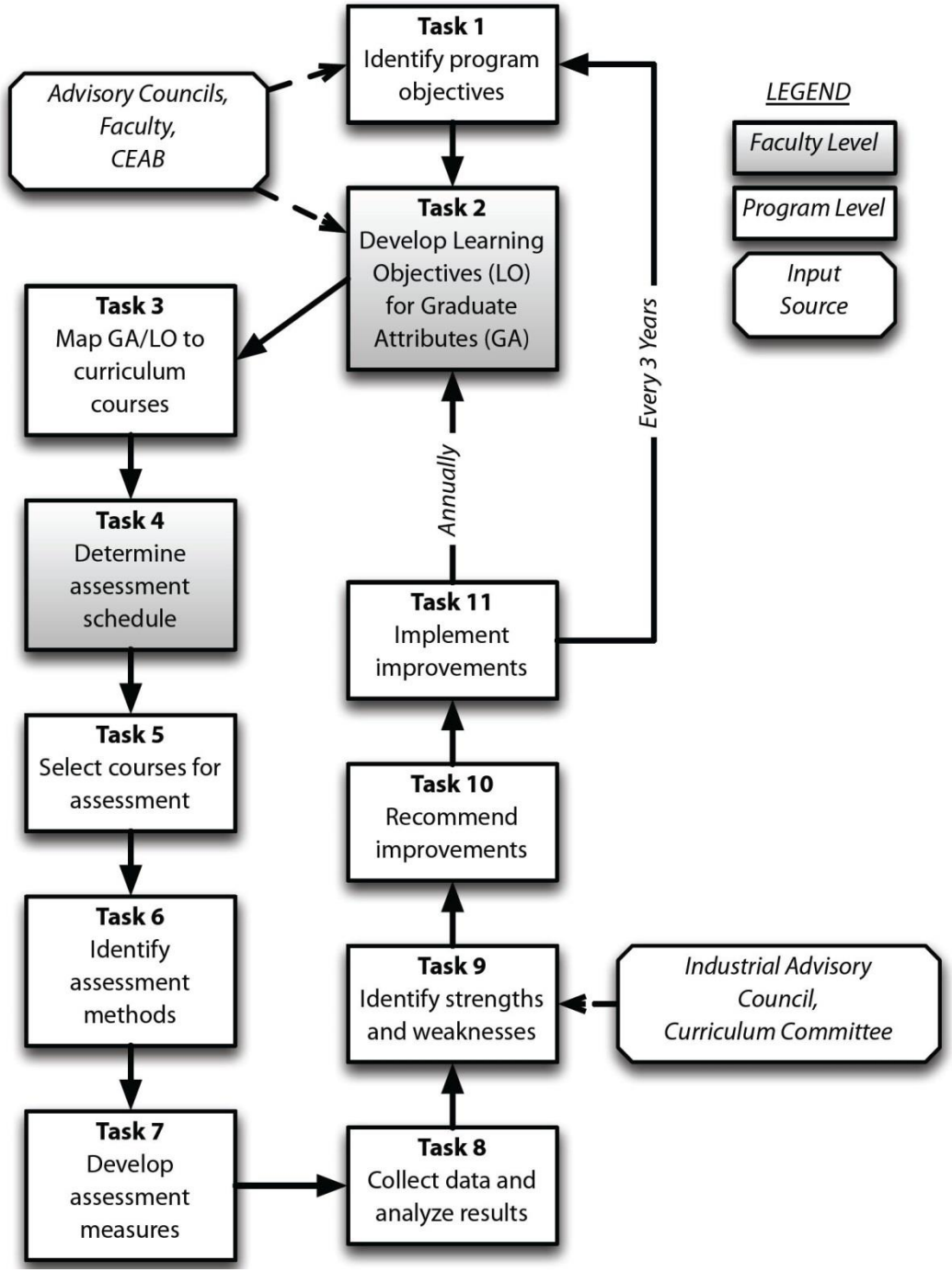
Assessment Plan

- The development of a system for assessing CEAB graduate attributes at Ryerson University started in April 2010.

- As assessment plan was developed during the summer of 2010.



Graduate Attributes	
3.1.1 A knowledge base for engineering	3.1.7 Communication Skills
3.1.2 Problem analysis	3.1.8 Professionalism
3.1.3 Investigation	3.1.9 Impact of engineering on society and the environment
3.1.4 Design	3.1.10 Ethics and equity
3.1.5 Use of engineering tools	3.1.11 Economics and project management
3.1.6 Individual and team work	3.1.12 Life-long learning


Task 1
Identify program objectives
Advisory Councils, Faculty, CEAB
Task 2
Develop Learning Objectives (LO) for Graduate Attributes (GA)
Task 3
Map GA/LO to curriculum courses
Task 4
Determine assessment schedule
Task 5
Select courses for assessment
Task 6
Identify assessment methods
Task 7
Develop assessment measures
Task 8
Collect data and analyze results
Task 9
Identify strengths and weaknesses
Industrial Advisory Council, Curriculum Committee
Task 10
Recommend improvements
Task 11
Implement improvements
Annually
Every 3 Years
LEGEND
Faculty Level
Program Level
Input Source

Learning Objectives (Indicators) for CEAB Graduate Attributes

Prepared by:

- Aerospace Engineering Working Group
- Biomedical Engineering Working Group
- Chemical Engineering Working Group
- Civil Engineering Working Group
- Computer Engineering Working Group
- Electrical Engineering Working Group
- Industrial Engineering Working Group
- Mechanical Engineering Working Group
- Common Engineering Working Group
- Science Working Group
- NSERC Design Chairs Working Group
- FEAS Working Group

Attribute 1. Knowledge Base for Engineering: Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.

Attribute Component	Learning Objectives		
	First year	Middle years	Graduating
1a Natural sciences	• Understands, interprets, articulates and applies a basic knowledge of science in the identification, formulation and solution of basic problems • Conducts experiments on science principles, and analyzes and interprets the obtained results	• Develops further knowledge of science in support of application to engineering problems	
1b Mathematics	• Develops analytical and numerical expressions using real problems • Applies appropriate mathematics principles to evaluate expressions, and to find and test potential solutions	• Applies mathematical principles, skills and tools to solve engineering problems, highlighting limitations or a range of applications • Uses algorithms and available software to solve mathematical models	• Integrates mathematics with natural and applied sciences to develop numerical and analytical models for processes and systems • Uses numerical and analytical models to predict, control and design component, system, and process behaviours
1c Engineering fundamentals and sciences	• Demonstrates skills in both engineering programming, and graphic communications and tools	• Applies science knowledge, skills and competency in modelling and solving engineering problems in components, systems and process • Demonstrates and applies core engineering principles and concepts to solve engineering problems	• Interconnects concepts of various engineering knowledge to design and solve real world engineering problems pertaining to systems and processes • Uses engineering knowledge to solve real world open-ended engineering problems
1d Knowledge base specialized engineering		• Demonstrates, integrates and applies specialized sub-disciplines and/or interdisciplinary engineering principles to systems or processes	• Uses specialized core engineering knowledge to understand and design a specific component, system or process

Attribute 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.

Attribute Component	Learning Objectives		
	First year	Middle years	Graduating
2a Processing	• Understands problem statements and identifies objectives • Recognizes engineering systems, variables and parameters • Interprets the results both qualitatively and quantitatively • Checks conclusions against objectives	• Evaluates sources of information • Checks the feasibility of design based on the obtained results • Assesses the reliability of conclusions	• Uses judgment in solving problems that have uncertainty and imprecise information • Identifies potential hazards and checks for alternative solutions
2b Modelling	• Understands the mathematical models used to describe engineering systems • Makes valid assumptions based on available information	• Formulates mathematical models using scientific and engineering principles • Justifies model assumptions and understands their limitations	• Compares model predictions with real-world data • Proposes model improvements
2c Solving	• Applies engineering mathematics and computations to solve mathematical models • Demonstrates an ability to use software solutions to formulate, analyze, and solve engineering problems	• Uses relevant computer simulation and visualization software • Evaluates the effect of uncertainty in model parameters, and of errors in numerical methods	• Solves improved models to address limitations

Attribute 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.

Attribute Component	Learning Objectives		
	First year	Middle years	Graduating
3a Information gathering	• Makes accurate use of technical literature and other information sources • Determines if information is relevant or irrelevant to the problem situation	• Determines the data that are appropriate to collect • Groups information and data • Designs experiments and investigations • Determines sampling strategies	• Appraises the validity/reliability of data relative to the degrees of error and limitations of theory and measurement • Creates simulated data for pre-analysis
3b Theory and measurement	• Recognizes the characteristics of, and distinguishes between, experimental investigations and theory	• Describes the limitations of both theory and measurement, including precision/accuracy • Applies mathematical and scientific principles to predict behaviour of systems or processes	• Integrates the calculations of error and uncertainty as integral components of investigations
3c Data analysis	• Demonstrates ability to conduct visual analysis	• Estimates errors, uncertainty and sensitivity in measurement, instrumentation and results • Conducts statistical processing/modelling of experimental data	• Practices critical and continual assessment of experimental data and associated models
3d Interpretation and synthesis	• Follows an investigation plan to answer a complex problem • Uses standard laboratory/ experimental protocols to ensure traceability of data	• Articulates the constraints and assumptions for the experiment • Constructs hypothesis or problem statement consistent with the information available and the constraints/parameters of the problem	• Creates predictions of outcomes and experimental uncertainties • Justifies the assumptions given test conditions • Draws on other knowledge to aid the decision-making process • Proposes improvements to investigative procedures and methods

Attribute 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.

Attribute Component[1]	Learning Objectives		
	First year	Middle years	Graduating
4a Design process overview	• Knows the process for designing a system, component or process to solve an open-ended complex problem	• Uses technical knowledge, design methodology, and appropriate design tools and related resources	• Anticipates the needs of the project, customizes design processes, analyzes progress, and revises plans as necessary
4b Problem definition	• Accurately determines design objectives and functional requirements • Identifies design constraints and establishes criteria for acceptability and durability of solutions • Documents required project outcomes • Uses information from appropriate sources	• Selects and uses an appropriate method for problem definition • Applies engineering principles and theories to define an accurate problem statement • Defines project scope based on economic analysis and project schedule • Recognizes that good problem definition assists the design process	• Evaluates adequacy of produced problem definition and consistency with needs statement and reality • Predicts unstated customer and user needs • Defines design parameter uncertainties and their impacts • Gathers information and identifies constraints (e.g. health and safety risks, codes, and economic, environmental, cultural, and societal factors)
4c Strategic planning	• Develops a design strategy (e.g. an overall plan of attack, prioritization of subtasks, establishment of timetables, and milestones by which progress may be evaluated)	• Recites definitions, names and lists steps in design process, and lists established management strategies and their elements • Distinguishes between and carries out design steps • Analyzes/evaluates progress of design • Produces a design strategy and uses it to guide a design • Recognizes that planning is important to design success	• Uses strategic planning in more complex design problems/systems

Attribute 4. Design (CONTD.): 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.

Attribute Component[1]	Learning Objectives		
	First year	Middle years	Graduating
4d Generation of solutions	• Transforms functional objectives/requirements into candidate solutions	• Describes differences between methods, and performs a specified method in hypothetical design situation • Analyzes failed candidates to suggest new candidates • Integrates generated ideas into design plan, and generates ideas creatively where established methods fail • Judges completeness and quality of generated candidates	• Generates solutions for more complex design engineering problems/systems
4e Feasibility analysis	• Describes the concept of feasibility analysis in design • Demonstrates the use of feasibility analysis for design case studies	• Performs feasibility analysis at an appropriate point in a design project and selects applicable method • Evaluates feasibility of alternatives or proposed solutions • Analyzes performance results, modelling results, and interfaces to determine source of failure • Uses results of feasibility analysis to select a candidate	• Uses feasibility analysis for more complex design engineering problems/systems
4f Evaluation	• Evaluates and ranks solutions based on functional specifications	• Describes differences between different evaluation methods, and selects and applies appropriate evaluation methods at a well-chosen point in a design project • Analyzes results of evaluation to discern additional criteria • Ranks/rates alternatives based on evaluation results	• Objectively determines relative value of feasible alternatives or proposed solutions
4g Selection/ decision making	• Selects the most feasible and suitable concept among design alternatives (simple case studies)	• Selects the best alternative and proceeds with design	• Applies selection and decision-making techniques to more complex design engineering problems/systems
4h Iterations	• Understands and practices iterative process in design problems	• Describes iterative process models of design and modifies, improves or elaborates a design state given a situation • Selects and performs strategies to generate information that may be used to modify, improve or elaborate a design state • Examines and critiques progress for opportunities to revise a design state as needed • Incorporates and integrates feedback and generates new knowledge about design problem	• Demonstrates iterative process in complex design engineering projects

Attribute 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.

Attribute Component	Learning Objectives		
	First year	Middle years	Graduating
5a Conducting experiment/ measurement	• Uses appropriate measurement techniques/devices to conduct experiments and collect data • Aware of measurement errors in instrumentation, human, and environment • Anticipates and minimizes experimental disruption • Follows protocols and safety procedures in conducting experiments	• Develops further knowledge of uses of modern instrumentation, data collection techniques, and equipment to conduct experiments and obtain valid data • Acknowledges possible disruption to existing surroundings and operations	• Evaluates and selects appropriate equipment, test apparatus, model etc. for measuring the variables in question
5b Interpreting and analyzing data	• Selects and explains different methods and the depth of analysis needed • Identifies different audiences and their analysis needs • Uses appropriate tools to analyze data • Organizes information into meaningful categories • Recognizes how results relate to theory and previous results • Presents information and lab results in a usable format	• Applies statistical procedures • Investigates possible artefacts with a balance of the analysis costs • Verifies and validates experimental results • Considers possible extensions of results to other areas • Interprets results with regard to given assumptions and constraints, and how they relate to theoretical nature or system • Assesses accuracy/precision of results • Understands the need to consider results from the viewpoint of different audiences	• Combines results of multiple experiments, history, or data sources • Determines the optimal solution based on specified criteria • Knows how results can be used to make a decision
5c Use of engineering tools	• Uses graphical design tools to produce clear diagrams and engineering sketches in both traditional and electronic forms • Uses current computer-based document-processing and graphics packages • Follows protocols and safety procedures when using skills and tools	• Lists current tools for analysis, simulation, visualization, synthesis, and design, and is competent in using them • Understands the accuracy/limitations of tools and verifies the results' credibility • Classifies/selects skills and tools congruent with project needs • Locates, catalogues and uses relevant information, with an ability to access, search,	• Designs and develops simple tools (software, hardware) to perform given tasks as required by the project • Evaluates skills and tools to identify their limitations with respect to the project needs • Evaluates results using several skills and tools to determine the

Attribute 6. Individual and Teamwork: An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.

Attribute Component	Learning Objectives		
	First year	Middle years	Graduating
6a Multi-disciplinary teamwork	• Recognizes the multi-disciplinary nature of engineering projects		• Effectively contributes to multidisciplinary team to achieve project goals
6b Individual and team work	• Recognizes a variety of working and learning preferences • Describes own temperament • Analyzes impact of own temperament on group work • Assumes responsibility for own work and is self directed	• Manages own time and processes effectively to achieve personal and team goals	• Applies principles of conflict management to resolve team issues
6c Leadership	• Exercises initiative and contributes to team goal setting	• Gives, receives and acts on constructive criticism	• Mentors and accepts mentoring from others in technical and team issues • Demonstrates capacity for technical or team leadership while respecting others' roles • Evaluates team effectiveness and plans for improvements

Attribute 7. Communication Skills: An ability to communicate complex engineering concepts within both the profession and society at large. Such ability includes reading, writing, speaking and listening; and, in particular, the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.

Attribute Component	Learning Objectives		
	First year	Middle years	Graduating
7a Written	• Summarizes and paraphrases written work accurately with appropriate citations • Formulates and expresses ideas in clear and correct grammar	• Produces a variety of documents using appropriate format, grammar and citation styles for technical and non-technical audiences • Cites evidence to construct and support an argument • Reads and appropriately responds to technical and non-technical written instructions	• Constructs effective arguments and draws conclusions using evidence • Writes and revises documents using appropriate discipline-specific conventions • Adapts format, content, organization and tone for various audiences • Demonstrates accurate use of technical vocabulary
7b Oral	• Organizes and delivers clear formal presentations following established guidelines	• Delivers persuasive and professional formal presentations adapted to the needs of the audience • Listens and appropriately responds to verbal questions and instructions	• Elicits and uses information and viewpoints from others • Presents instructions and information clearly and concisely • Demonstrates confidence in formal and informal oral communications • Explains and interprets results for various audiences and purposes
7c Communication tools	• Demonstrates functional use of current software for written, oral, and graphical communications in engineering contexts		• Demonstrates fluency in using current software for communications appropriate to discipline
7d Graphical	• Identifies and uses standard conventions in graphical expression (e.g. engineering drawings, plots, legends) • Uses figures and tables appropriately to complement text • Uses standard conventions	• Illustrates concepts in graphical form	• Uses graphics to explain, interpret and assess information

Attribute 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.

Attribute Component	Learning Objectives		
	First Year	Middle Years	Graduating
8a Relationships	• Demonstrates punctuality, responsibility, communication etiquette, and active participation in team meetings		• Contributes to teamwork in an equitable and timely manner
8b Public interest	• Begins to know the role of the engineer in society, including responsibility for protecting the public interest	• Knows the role of the engineer in society, including responsibility for protecting the public interest	• Incorporates the public interest in the decision-making process
8c Professional practice and legal responsibilities	• Knows the legal requirements governing engineering activities, including personnel, health and safety, and risk issues (i.e. WHMIS)	• Begins to integrate standards and codes of practice relevant to the discipline into decision-making processes	• Integrates standards and codes of practice relevant to the discipline into decision-making processes • Knows regulations governing professional practice (e.g. Professional Engineers Act) • Adheres to guidelines dictating use of intellectual property and contractual issues

Attribute 9. Impact of Engineering on Society and Environment

An ability to analyze social and environmental aspects of engineering activities. This 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.

Attribute Component	Learning Objectives		
	First year	Middle years	Graduating
9a Environment	• Describes relations between human activity and environment • Integrates management techniques for sustainable development • Is able to determine the impact of his/her decisions and activities on the environment • Is aware that ethical and transparent behavior contributes to sustainable environmental development	• Understands how ethical and transparent behavior contributes to sustainable development	• Considers economic, social and environmental factors in decisions • Manages relevant legal requirements that govern engineering activities • Understands the impact of his/her decisions and activities on the environment • Applies sustainable development principles, while complying with laws and regulations related to the environment
9b Interactions	• Understands the role of engineering for the benefit of society and the environment	• Describes interactions between technical systems and social, cultural, environmental, economic and political contexts	• Integrates relevant legal requirements that govern engineering activities

Attribute 10. Ethics and equity: An ability to apply professional ethics, accountability and equity.			
Attribute Component	Learning Objectives		
	First year	Middle years	Graduating
10a Ethics and professionalism	• Identifies items from the professional codes of conduct • Describes ethical issues and how they affect the individual, the company and the public • Demonstrates behaviour congruent with the university code of conduct • Describes consequences of deviating from professional codes of conduct and the university code of conduct	• Follows ethical protocols when collecting data • Follows ethical procedures when using skills and tools • Determines ethical risk components	• Recognizes and understands basic legal principles relating to business organizations, the Canadian legal system, torts, contracts and other legal issues that are faced by engineers in their practices. • Evaluates competing legal principles and analyzes issues in terms of these legal principles and to either make decisions accordingly or to seek professional legal assistance. • Assesses ethical risks and evaluates situations and actions in terms of the professional code of ethics for engineers, with a focus on that for Ontario. • Evaluates competing values in decision making, and analyzes components of a decision in terms of professional codes of ethics and other ethical guidelines and makes decisions correspondingly
10b Equity	• Understands the principles of equity		• Evaluates and applies equity principles in case studies

Attribute 12. Life-long Learning

An ability to identify and address one's own educational needs in a changing world in ways sufficient to maintain competence and enable a personal contribution to the advancement of knowledge.

Attribute Component	Learning Objectives		
	First Year	Middle Years	Graduating
12a Information sourcing and evaluation	• Identifies appropriate technical literature and other information sources to meet a need • Clearly attributes sources	• Critically evaluates the procured information for authority, currency and objectivity • Makes accurate and appropriate use of technical literature and other information sources	
12b Professional development	• Identifies resources and professional associations that address ongoing professional development	• Recognizes the need for ongoing self-education and developing relationships with mentors and experts in the field	• Gains a working knowledge of the literature of the field and how it is produced
12c Knowledge needs identification	• Identifies a specific learning need or knowledge gap	• Identifies new changes in the field that highlight the ongoing need for professional development	

Partial Curriculum Mapping of Graduate Attributes and Courses (Biomedical Engineering)

Course		Knowledge Base	Problem Analysis	Investigation	Design	Use of Engineering Tools	Individual and Team work	Communication skills	Professionalism	Impact on Society and the Environment	Ethics and Equity	Economics and Project Management	Life-Long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
CEN 100	Introduction to Engineering				X			X	X	X	X		
CHY 102	General Chemistry	X	X										
MTH 140	Calculus I	X	X										
MTH 141	Linear Algebra	X	X										
PCS 211	Physics: Mechanics	X	X	X									
BME 100	Introduction to Biomedical Engineering							X	X		X		
CPS 125	Digital Computation and Programming	X	X										
ECN 801	Principles of Engineering Economics											X	
EES 512 (ELE 202)	Electric Circuits		X	X	X	X							
MTH 240	Calculus II	X	X										
PCS 125	Waves & Fields	X	X	X									

Partial Curriculum Mapping of Graduate Attributes and Courses (Biomedical Engineering)

Graduate Attribute	Semester							
	1	2	3	4	5	6	7	8
Knowledge base	CHY 102	MTH 240	BME 323	BME 423	BME 501	EES 612	BME 703	BME 804
	PCS 211	PCS 125	BME 328	BLG 601	BLG 701		BME 704	BME 809
	MTH 140	CPS 125	MTH 312		BME 516	MTH 410		
	MTH 141		BME 229					
			BLG 143					
Problem analysis	CHY 102	MTH 240	BME 323	BME 423	BME 501	BME 639	BME 703	BME 804
	MTH 140	EES 512 (ELE 202)	BME 328	EES 604	BME 516	EES 612	BME 704	BME 809
	MTH 141	PCS 125	MTH 312			MTH 410		BME 872
	PCS 211	CPS 125						
Investigation	PCS 211	PCS 125	BME 323	BME 423		BME 639	BME 703	BME 804
		EES 512 (ELE 202)	BLG 143	EES 604	BME 516	EES 612	BME 704	BME 808
			BME 229			MTH 410	BME 705	BME 809
								BME 872
							BME 705	BME 800
							BME 700	
							Liberal-C	

Schedule of Assessment of CEAB Graduate Attributes

2009-2010	2010-2011	2011-2012
	• Communication skills • Professionalism • Impact of engineering on society and the environment • Ethics and equity • Design (part one)	• Individual and teamwork • Economics and project management • Lifelong learning • Design (part two)
2012-2013 **2015-2016**	**2013-2014** **2016-2017**	**2014-2015** **2017-2018**
• Knowledge base for engineering • Problem analysis • Investigation • Use of engineering tools	• Communication skills • Professionalism • Impact of engineering on society and the environment • Ethics and equity • Design	• Individual and teamwork • Economics and project management • Lifelong learning • Design

Performance Levels of Indicators

Three Levels

- Below Expectations
- Meets Expectations
- Exceeds Expectations

Graduate Attribute Assessment

- Assessment for continual improvement has been conducted every year.
- Starting in the 2014/2015 accreditation cycle, CEAB will make decisions about compliance with the graduate attribute criteria.

Graduate Attribute Assessment – Current Status

- Four performance levels of indicators will be used:
  - Fails to meet expectations
  - Minimally meets expectations
  - Adequately meets expectations
  - Exceeds expectations
- All graduate attributes will be assessed every year.
- All engineering courses will collect assessment data for their respective learning objectives, as opposed to assessments in selected courses only.
- Excel-based tools have been developed for collecting assessment data.

Issues

- Information management, data depository
- Utilization of information: aggregation of assessment results over different years and courses?

Instructions: List all learning activities (courses etc) that relate to specific graduate attributes. Highlight those activities where student achievement has been, or is planned to be, assessed.
Please delete the sample entries and highlighting to use this table.

Table 3.1.1: Summary Graduate Attribute Curriculum Map

Graduate Attribute	Semester							
	1	2	3	4	5	6	7	8
Knowledge base	CHEM101	PHYS102	MATH201	MATH202	MATH301	DSPE302	DSPE401	DSPE402
	MATH101	MATH102	MATH203	ENGR202	DSPE301	DSPE304	DSPE403	DSPE404
	ENGR101	ENGR102	ENGR201	NSCI202	DSPE303	DSPE306	DSPE405	DSPE406
	ENGR103	CMPT102	NSCI201	NSCI204	DSPE305			
			DSPE201	DSPE202				
			STAT201					
Problem analysis	ENGR103		DSPE201		DSPE303	DSPE302	DESX401	
					DSPE305	DSPE306	DESX403	
Investigation				ENGR202		DSPE302	DESX401	
				DSPE202			DESX403	
Design	DESX101	DESX102			DESX301	DESX302	DESX401	DESX402
					DSPE303	DSPE304	DESX403	DESX404
							DSPE405	DSPE406
Use of engineering tools		ENGR102			DSPE301	CO-OP	DSPE401	
		CMPT102			CO-OP		DESX401	
							DESX403	
Individual and team work	DESX101	DESX102			DESX301	DESX302	DESX401	DESX402
					CO-OP	CO-OP	DESX403	DESX404

Instructions: List the indicators associated with each attribute together with the learning activities where the indicator has been used to assess performance of students (as highlighted in Table 3.1.1). Rows are provided but there is no expectation that they will all be used for any particular attribute. If more rows are needed, add rows as required.
Please delete the sample entries and highlighting to use this table.

Table 3.1.2: Indicators and Learning Activities Assessed

Graduate Attribute	Indicator	Relative Level		
		Inroductory	Intermediate	Advanced
Knowledge base	Creates mathematical descriptions for model real-world problems	MATH101		
	Selects and describes appropriate tools and methodologies to solve mathematical problems		MATH202	
	Recalls and describes fundamental concepts in chemistry	CHEM101	NSCI204	
	Recalls and describes fundamental concepts in physics	PHYS102	NSCI204	
	Recalls and describes fundamental engineering concepts	ENGR101		
	Comprehends and applies fundamental engineering concepts		ENGR202	
	Comprehends and applies discipline-specific engineering concepts		DSPE202	DSPE401
Problem analysis	Identifies known and unknown information, uncertainties and biases	ENGR103	DSPE201	DSPE302
	Creates process for solving problem including approximations and assumptions	ENGR103	DSPE201	DESX401
	Selects and applies appropriate quantitative model and analysis to solve problem	ENGR103	DSPE302	DESX401
	Evaluates validity of results, risks, errors and uncertainties	ENGR103	DSPE302	DESX401

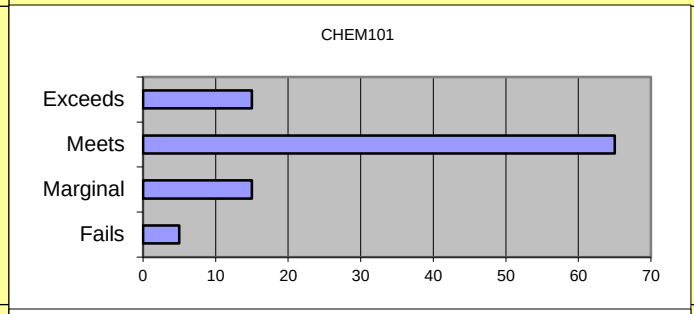
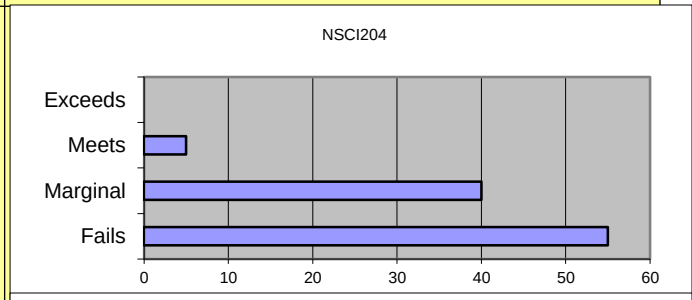
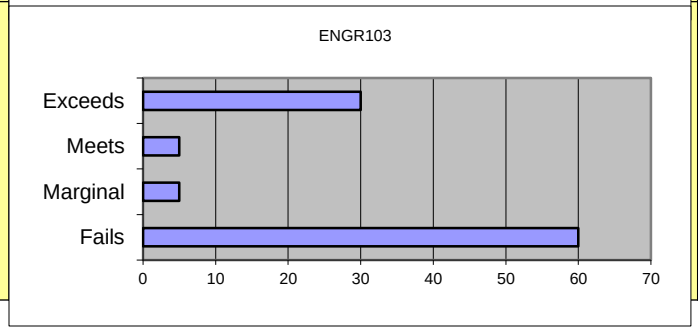
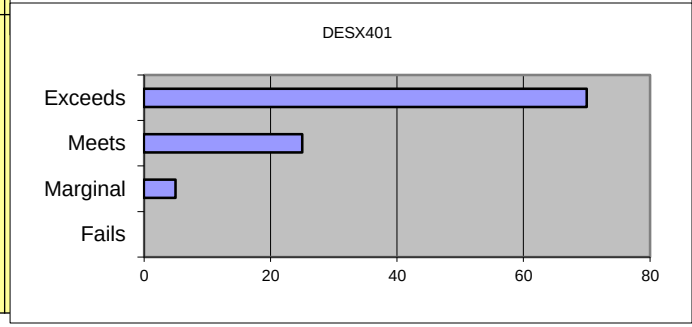
Instructions: Provide examples of the assessment tools (rubric or other) used to comparatively evaluate performance for any 12 indicators listed in Table 3.1.2. At least one indicator for each of the 12 attributes must be included. Change column headings as required. Add or delete columns as required. Provide performance descriptors that exactly correspond to those used in assessment. A complete set of all assessment tools should be available to the visiting team at the time of the visit. *Please delete the sample entries and highlighting to use this table. If a program uses a different number of levels of performance than what is in the example, columns may be added or deleted. The example shows four levels of achievement but this can be modified to suit the program.*

Table 3.1.3: Examples of Assessment Tools

Graduate Attribute	Performance level	Level 0	Level 1	Level 2	Level 3
	Level descriptor	*Fails to meet expectations*	*Minimally meets expectations*	*Adequately meets expectations*	*Exceeds expectations*
Knowledge base	*Recalls and describes fundamental concepts in chemistry*	*Less than 50% on final examination*	*50% to 60% on final examination*	*60% to 80% on final examination*	*Greater than 80% on final examination*
Problem analysis	*Creates process for solving problem including approximations and assumptions*	*Process unacceptable and treatment of approximations and assumptions inadequate*	*Process acceptable but treatment of approximations and/or assumptions marginal*	*Process and treatment of approximations and assumptions acceptable*	*Process and/or treatment of approximations and assumptions exceptional*
Investigation	*Indicator:*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*
Design	*Indicator:*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*
Use of engineering tools	*Indicator:*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*
Individual and team work	*Indicator:*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*
Communication skills	*Indicator:*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*
Professionalism	*Indicator:*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*	*Performance descriptor*

Instructions: Provide examples of the assessment results for the 12 indicators listed in Table 3.1.3. If possible, provide data for multiple assessments collected at different times for the same learning activity, and multiple assessments using the same tool in different learning activities. A complete set and summary of all results should be available to the visiting team at the time of the visit. *Please delete data and highlighting to use this table.*

Table 3.1.4: Examples of Assessment Results

Graduate Attribute	Indicator	Results (add more columns as required)	
Knowledge base	*Recalls and describes fundamental concepts in chemistry*	*Graphic/Chart*	*Graphic/Chart*
Problem analysis	*Creates process for solving problem including approximations and assumptions*		
Investigation	*Indicator:*		

Instructions: Provide answers to the following questions with respect to the feedback process and continual improvement.

Table 3.2.1: Continual Improvement Process and Feedback

Discuss the specific results from Table 3.1.4 with respect to future program expectations. What conclusions do you draw from the specific data presented?
Who are the stakeholders consulted (or to be consulted) in the program revision process? How will the consultations take place?
How are the results from data collection and analysis being used (or are planned to be used) in support of program improvement?
What specific actions have been planned or implemented as a result of the data collection and analysis with respect to expectations for and achievement of graduate attributes?