ABET Outcomes Explained

(Based on resources found at http://www.foundationcoalition.org/fcsearch/index.html)

Engineering programs must demonstrate that their students attain the following outcomes:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Bloom’s Taxonomy

Bloom's Taxonomy is a multi-tiered model of classifying thinking according to six cognitive levels of complexity. Throughout the years, the levels have often been depicted as a stairway, leading many teachers to encourage their students to "climb to a higher (level of) thought." The lowest three levels are: knowledge, comprehension, and application. The highest three levels are: analysis, synthesis, and evaluation. "The taxonomy is hierarchical; [in that] each level is subsumed by the higher levels. In other words, a student functioning at the 'application' level has also mastered the material at the 'knowledge' and 'comprehension' levels." One can easily see how this arrangement led to natural divisions of lower and higher level thinking.

Clearly, Bloom's Taxonomy has stood the test of time. Due to its long history and popularity, it has been condensed, expanded, and reinterpreted in a variety of ways. Research findings have led to the discovery of a veritable smorgasbord of interpretations and applications falling on a continuum ranging from tight overviews to expanded explanations. Nonetheless, one recent revision (designed by one of the co-editors of the original taxonomy along with a former Bloom student) merits particular attention.

- **Remembering**: Retrieving, recognizing, and recalling relevant knowledge from long-term memory.
- **Understanding**: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
- **Applying**: Carrying out or using a procedure through executing, or implementing.
- **Analyzing**: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.
- **Evaluating**: Making judgments based on criteria and standards through checking and critiquing.
- **Creating**: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

Taxonomy Level:	**Knowledge**	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Valuation**
Bloom’s Definition:	Remembering previously learned information	Grasping the meaning of information	Applying knowledge to actual situations	Breaking down objects or ideas into simpler parts and seeing how the parts relate and are organized	Rearranging component ideas into a new whole	Making judgments based on internal evidence or external criteria	Sensitivity willingness to receive (awareness w/o assessment, willingness to suspend judgment); Actively respond (comply, commit, internal

							satisfaction); Value (acceptance of worth, preference); Organize (when values conflict)
Verbs:	Arrange, define, describe, duplicate, identify, label, list, match, memorize, name, order, outline, recognize, relate, recall, repeat, reproduce, select, state	Classify, convert, defend, describe, discuss, distinguish, estimate, explain, express, extend, generalized, give example(s), identify, indicate, infer, locate, paraphrase, predict, recognize, rewrite, report, restate, review, select, summarize, translate	Apply, change, choose, compute, demonstrate, discover, dramatize, employ, illustrate, interpret, manipulate, modify, operate, practice, predict, prepare, produce, relate schedule, show, sketch, solve, use, write	Analyze, appraise, breakdown, calculate, categorize, compare, contrast, criticize, diagram, differentiate, discriminate, distinguish, examine, experiment, identify, illustrate, infer, model, outline, point out, question, relate, select, separate, subdivide, test	Arrange, assemble, categorize, collect, combine, comply, compose, construct, create, design, develop, devise, explain, formulate, generate, plan, prepare, propose, rearrange, reconstruct, relate, reorganize, revise, rewrite, set up, summarize, synthesize, tell, write	Appraise, argue, assess, attach, choose, compare, conclude, contrast, defend, describe, discriminate, estimate, evaluate, explain, judge, justify, interpret, relate, predict, rate, select, summarize, support, value	Accept, challenge, defend, respect, question, support, enjoy

Outcome A: Graduates have the ability to apply knowledge of mathematics, science, and engineering

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome Element: Apply knowledge of mathematics	Recognizes functional relationships among independent and dependent variables. Describes physical significance of functions, derivatives of functions, and integrals of functions	Explains the role of mathematics as a tool for modeling systems and processes.	Applies mathematical principles to obtain analytical or numerical solution to model equations. Chooses a mathematical model of a system or process appropriate for the required accuracy.	Identifies mathematical and physical assumptions that allow model to be developed and solved at the level of accuracy required. Apply concepts of integral and differential calculus and linear algebra to solve problems.	Combines mathematics principles to formulate models of chemical, physical, and/or biological processes and systems as relevant to area of concentration.	Evaluates validity and reliability of mathematical models by comparing model solutions to either known results for simplified cases (i.e. Numerical solutions compared to asymptotic analytical solutions) or relevant empirical data. Interprets mathematical model results to estimate accuracy and reliability.	Accepts limitations of mathematical models to physical reality. Challenges predictions of mathematical models until independently verified.
Outcome Element: Apply knowledge of science and engineering fundamentals	Describes fundamental scientific and engineering principles in chemical, physical, and/ or biological processes and systems as relevant to area of concentration.	Identifies which fundamental scientific and engineering principles govern the performance of a given process or system.	Applies engineering science principles as relevant to area of concentration, e.g.: "Conservation" principles of total mass, species mass, linear momentum, angular momentum, energy, or charge to model chemical, physical, and/or biological processes or	Analyzes modeling results of systems or processes using fundamental scientific and engineering principles. Analyzes data sets using statistical concepts.	Combines scientific and engineering principles to formulate models of processes and systems.	Evaluates validity and reliability of model solutions by comparing model predictions to either known experimental results for specific processes or systems or simplified theoretical results. Interprets physical significance of model predictions.	Accepts limitations of mathematical models in predicting the performance of chemical, physical, and/or biological processes or systems as relevant to area of concentration. Accepts the role of mathematical models in guiding engineering design

			systems. Rate and constitutive equations to model relevant chemical, physical, and/or biological processes or systems. Thermodynamic principles to predict bounds on the performance of processes or systems. Materials principles to characterize behavior of physical, chemical, and/or biological processes or systems.			Defends use of selected engineering science principles to model a specific process or system.	work. Accepts variance between model predictions and process or system performance.

Outcome B: Graduates have the ability to design and conduct experiments, as well as to analyze and interpret data

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome Element: Designing Experiments	Can recognize applicable analytical models, possible simulators (e.g. physical, digital, continuous, other format), testing apparatus, databases, models, etc. Can identify applicable theory and recognize the past history Can describe different measurement techniques and alternatives based on cost, etc. Gives examples of possible disruptions that may occur while conducting experiment that could affect experimental data Can discuss laboratory/experimental protocols Understands the need for proper units	Can indicate how existing theory/history differs/complements current question Can select the variables in questioned (controllable, level of variation, impact with other variables) Identifies the constraints and assumptions for the experiment cost, time, equipment Can construct an appropriate hypothesis or problem statement Can select appropriate equipment, test apparatus, model, etc. for measuring variables in question Aware of orderliness and integrity of data	Can use existing theory/history to design an experiment Chooses the measure(s) of effectiveness by which the outcome or the alternative will be evaluated – cost, quality, value, time to complete, feasibility Formulates the control and evaluating alternatives of the experiment Develops contingency plans Apply constraints and assumptions into experimental design Determines the data that are appropriate to collect Specifies and justifies the	Predicts experimental uncertainties	Seeks information for experiment from multiple sources		Accepts the limitations and extensions that an experiment built can be used to represent the system

			assumptions given test conditions				
Outcome: Element: Conduct Experiments		Aware of measurement errors in instrumentation, human, environment Anticipates and minimizes experimental disruptions via pilot study	Acknowledges possible disruptions to existing surroundings and operations Uses appropriate measurement techniques to collect data Facilitates use of modern data collection techniques (computer for data logging) Follows ethical protocols when collecting data Documents collection procedures such that experiment may be repeated Anticipates and minimizes data errors via pilot study				
Outcome Element: Analyze Data		Can select and explain different methods of analysis (descriptive and inferential) and depth of the analysis	Uses appropriate tools to analyze data Selects and uses	Can apply statistical procedures Investigates	Organizes information into meaningful categories		

		needed Can identify different audiences and their analysis/summary needs Can identify artifacts/confounding elements that may result	appropriate, self-explanatory graph formats for data Prepares analysis such that results can be replicated	possible artifacts with a balance of costs associated with the analysis			
Outcome Element: Interpret Data		Can recognize how results relate or differ from theory or previous results	Can verify and validate experimental results	Questions whether constraints hold in both experiment and real world Relates and makes a connection between the measured property and variables Examines data WRT measures of effectiveness Makes considerations for risk	Combine results of multiple experiments, history or data sources Clearly presents information usable in formats (graph, numerical, text, etc.)	Considers possible extensions of results to other areas Interprets what the results mean with respect to the assumptions and constraints Interprets results with regards to how results relate the theoretical state of nature or system Selects the most appropriate solutions based on solution criteria Assesses the accuracy and precision of the	Respects and understands the need to consider results from different view points and audiences Appraises how results can be used to make a decision Recognizes experiment's limitations

						results Interprets results with respect to the original hypothesis	

Outcome C: Graduates have the ability to design a system, component, or process to meet desired needs

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome Element: Need Recognition Identify stated and unstated wants and needs that motivate the design effort; convert them into a needs statement.)	Recite definitions; name established methods and list their steps	Describe differences between different methods; carry out steps in a hypothetical design situation when asked	Select and perform appropriate method at a proper stage of a design project	Analyze perceived wants and needs to isolate the most relevant needs	Produce a clear and unambiguous needs statement in a design project	Assess/verify consistency of needs statement with customer's and societal needs	Believe that design effort benefits from a clear, unambiguous needs statement
Outcome Element: Problem Definition Determine design objectives and functional requirements based on needs statement, identify constraints on the design problem, and establish criteria for acceptability and desirability of solutions.	Recite definitions; name established methods and list their steps	Describe differences between different methods; carry out steps when asked	Select and utilize appropriate method for problem definition; success-fully produce problem definition at an appropriate stage of a design project	Analyze a needs statement to isolate information pertaining to problem definition	Guide a design project by use of the produced problem definition	Evaluate adequacy and consistency of produced problem definition with needs statement, reality	Believe that good problem definition assists the design process
Outcome Element: Planning (Strategic) Development of a design strategy, including an overall plan of attack, decomposition of design problem into	Recite definitions; name and list steps in design process; list established management strategies and their elements	Describe differences between different design steps; carry out steps when asked	Select and perform appropriate design stage at an appropriate point in a design project	Analyze progress of design in order to revise plan as needed	Produce a design strategy and use it to guide a design project	Evaluate progress by comparing current design state to design plan	Believe that planning is important to design success

subtasks, prioritization of subtasks, establishment of timetables and milestones by which progress may be evaluated.							
Outcome Element: Control and Management (Tactical) Guidance of course of action during design and in response to changing conditions.	Name project monitoring techniques; list their elements and applications; list methods to modify design plans	Describe differences between different techniques; modify a given design plan given a situation	Select and perform appropriate monitoring, modification method during a design project	Analyze progress of design in order to revise plan as needed; analyze errors to determine proper reaction	Maintain a design strategy during a design project	Judge quality of monitoring; judge quality of revisions to plan	Believe that changes in original plan are acceptable and typical
Outcome Element: Information Gathering Gather information about the design problem, including the need for a solution, user needs and expectations, relevant engineering fundamentals and technology, and feedback from users.	Name and list steps in information gathering; list established methods and their elements	Use specified information gathering method to research a specified design issue	Recognize need for information during a design project; gather information using an appropriate method	Analyze information need to determine type of information to gather during a design project	Employ gathered information in design decisions	Judge quality of gathered information	Believe that information gathering is important to design success
Outcome Element: Generate Ideas Transform functional objectives/requirements into candidate solutions.	Name established idea generation methods and list their steps and attributes	Describe differences between methods; perform specified method in hypothetical design situation when asked	Select and perform appropriate idea generation methods in a design project	Analyze failed candidates to suggest new candidates	Integrate generated ideas into design plan; generate ideas creatively or ad hoc where established methods fail	Judge completeness, quality of generated candidates	Believe that systematic idea generation is important to design success

Outcome Element: Modeling Employ models / representations / simulations of the physical world to provide information for design decisions.	Recite definitions; name and list modeling and simulation methods and representation techniques, their elements and applicability	Describe differences between methods; use a specified representation to investigate a specified design issue, carry out steps of a specified method when asked	Select and perform model or representation at an appropriate point in a design project	Analyze output of model or representation	Incorporate output of model into the design project	Evaluate quality of model, simulation, or representation and its output	Believe that modeling is important to design success
Outcome Element: Feasibility Evaluate feasibility of alternatives or proposed solutions by considering stated constraints as well as implied constraints such as manufacturability, cost, compatibility	Recite definition of feasibility; name and list steps in feasibility analysis methods	Can recognize feasible candidates among a selection of candidates (using a specified method)	Perform feasibility analysis at an appropriate point in a design project, selecting applicable method	Analyze performance results, modeling results, interfaces to determine source of failure	Use the result of feasibility analysis to choose a candidate; employ insights gained	Evaluate judgments of feasibility, particularly with respect to possible biases	Believe that recognizing feasibility is important to design success
Outcome Element: Evaluation Objectively determine relative value of feasible alternatives or proposed solutions by comparing expected or actual performance to evaluation criteria.	Name and list evaluation methods and their elements, applicability	Describe differences between different methods; carry out specified method when asked	Select and apply appropriate evaluation method at an appropriate point in a design project	Analyze results of evaluation to discern additional criteria	Rank or otherwise rate candidates based on evaluation results; report on expected performance of candidates	Judge quality and comprehensiveness of evaluation, particularly by recognizing possible biases	Believe that evaluation is important to design success; belief in value of systematic, unbiased methods of evaluation
Outcome Element: Selection / Decision	Name established decision and selection methods and their steps and applicability; list	Describe differences between decision and selection methods; make a	Select and perform appropriate decision and selection methods at an appropriate	Analyze feasible alternatives to identify bases for decision, selection	Select a candidate and proceed with design	Evaluate quality of selection or decision, e.g. with respect to possible bias	Believe that timely selection, structured decision process is important to design

Selection of most feasible and suitable concept among design alternatives.	common decision criteria	decision or selection given a set of alternatives	point in a design project				success
Outcome Element: Implementation Creating an instance of physical products and processes for purpose of testing or production	List and outline manufacturing and prototyping methods; list applications, strengths, weaknesses	Describe differences between methods; select an appropriate method given a situation; build a prototype by a specified method	Select and implement fabrication, production in a design project	Analyze output to suggest alternate methods of fabrication or production	Build a prototype or manufacture the artifact; incorporate components into a final design	Judge quality of prototype or product	Believe that prototyping and manufacturing are important to design success
Outcome Element: Communication Exchange of information with others, utilizing appropriate formats.	Name types of communication and their formats; name and list steps in communication methods; list difficulties, strengths, and applications	Describe differences between different forms of communication; carry out when asked; identify possible pitfalls in a hypothetical design situation	Select and perform appropriate form of communication at appropriate points in a design project	Analyze messages to identify implied information; recognize errors and means of remedy	Communicate successfully throughout a design project; direct received communications to proper recipient	Evaluate effectiveness of chosen format and message	Believe that good communication and group dynamics is important to design success
Outcome Element: Documentation Produce usable documents of record regarding the design process and design state, including decision history and criteria, project plan and progress, intermediate design states, finished product and use of product.	Name common forms and purposes of documentation; list common targets of documentation, elements of good documentation	Describe differences between forms of documentation; document a specific design action by a specific form when asked	Select and perform appropriate documentation at an appropriate point in a design project	Analyze design activity to locate targets of documentation;	Create comprehensive history of design process as design proceeds	Evaluate quality of produced documentation and choice of documentation format (e.g., given audience)	Believe that diligent documentation is important to design success

Outcome Element: Iteration Utilize strategies to inform design decisions which may contribute to a change in a design state (e.g., the problem definition, problem solutions, or design process plan).	Recites definitions; identifies strategies or procedures that generate information which may contribute to design decisions.	Can describe iterative process models of design; modify, improve or elaborate a design state given a situation.	Select and perform strategies to generate information that may be used to modify, improve or elaborate a design state.	Examine and critique progress for opportunities to revise design state as needed; analyze violations, inconsistencies, or conflicts to determine proper response.	Incorporate and integrate feedback; Generate new knowledge about design problem; Develop new strategies or tools to monitor progress.	Critique quality of monitoring, strategies and tools; judge quality of revisions to design state.	Believe that changes to original plan or products are acceptable, typical, and important to design success

Outcome D: Graduates have the ability to function on multi-disciplinary teams

Collaboration/ Conflict Mgt.	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Team Development: Basic principles of group development and interpersonal dynamics	Defines stages of team development and the sequence in which they occur	Recognizes distinctions between stages in team development Identifies specific behaviors and skills that support team effectiveness	Determines a teams current state of development	Distinguishes effective team process relative to ineffective team process	Formulates plans for helping a team develop from one stage to the next	Accurately evaluates a teams current state of development and prescribe plans for enhancing effectiveness	
Interpersonal style: Recognizing and capitalizing on differences in style and perspective	Recognizes differences in interpersonal style	Describes how differences in interpersonal style impact team behavior and performance	Modifies his/her own style to accommodate needs of others	Can compare and contrast differences in team members interpersonal styles	Capitalizes on individual differences in style and perspective to improve team performance	Evaluates the pros and cons of different style types relative to team performance	Respects differences in style, culture, experience or knowledge
Conflict Management: Principles of problem-based Conflict mgt.	Defines principles of constructive conflict management (win-win; issues versus positions; objective criteria; interest based negotiation)	Describes how to use principles of constructive conflict management	Applies principles of constructive conflict management to interactions with others	Identifies underlying issues associated with conflicting positions	Effectively constructs solutions that integrate seemingly contrary positions	Evaluates conflict outcomes against objective criteria	Remains nonjudgmental when disagreeing with others Values alternative perspectives Maintains a neutral perspective when resolving differences between others
Participation: Understanding of and willingness to be fully involved	Can define what participation means in a team setting	Describes what one must to participate fully in team projects	Shares responsibilities with other team members		Helps team create plans for ensuring/improving participation		Is cooperative and open with others Enjoys interacting with

in team efforts			Demonstrates commitment to team goals Supports other team members in their assigned roles Is flexible and responsive to others needs		Encourages involvement from others		others to complete work Views problems as team issues not as things that affect only one or two people
Team Communication	**Knowledge**	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Valuation**
Active Listening: Conveying understanding and using listening skills to move a conversation forward		Describes active listening and its role in team effectiveness	Restates what has been said to show understanding Asks open-ended questions in order to encourage discussion Summarizes main points of discussions before moving on to other topics Asks questions to clarify misunderstandings Conveys understanding of others perspectives	Identifies relationships between actively listening and team performance	Uses active listening skills to enhance knowledge and develop better understanding (e.g. to clarify design requirements)	Accurately assesses own/others ability to listen actively	Is sensitive to other team members feelings and personal interests Listens attentively to others without interrupting Conveys interest in what others are saying
Feedback: Giving and receiving		Understands principles of constructive feedback	Gives specific and constructive feedback to other	Identifies relationships between active listening and team	Incorporates feedback from others into revisions/	Accurately assesses own/others ability to give receive/ feedback	Is receptive to feedback and criticism from others

constructive criticism			team members Appropriately balances negative comments with positive ones Solicits feedback from others Avoids judgmental language or cheap shots when giving feedback	performance	improvements		Is sensitive to others reactions to feedback/ criticism
Team Communication	**Knowledge**	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Valuation**
Influencing others: Persuading others through well reasoned use of facts and clear conveyance of ideas		Understands principles of how to influence others	Articulates ideas clearly and concisely Uses specific examples to make points and convey ideas Persuades others to adopt his/her point of view		Develops plans and presentations that influence others	Accurately assesses own/others ability to influence others	Is comfortable expressing alternative points of view
Sharing Information: Providing and reviewing information in a		Describes important ways of sharing information in a team setting	Shares information with others on the team Provides information on	Differentiates between useful and unnecessary information	Combines different kinds/sources of information to create solutions or new ideas		Is open to new information and ideas

timely manner			time				
Team Decision-making	**Knowledge**	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Valuation**
Defining a Problem: Identifying and articulating the problem to be solved	Defines specific steps in the decision-making process	Describes steps in decision-making process and how they relate to one another	Applies a systematic decision-making process to solving problems	Collects data to pinpoint problems Analyzes problems objectively Tests assumptions underlying ideas, positions or statements	Recognizes interrelationships among problems and issues		
Innovation and idea generation: Generating creative and viable solutions	Defines innovation and idea generation	Describes how innovation and idea generation are distinct and how they are similar -Understands tools and techniques for generating ideas	Uses brainstorming and other idea generation techniques Participates in the development of ideas		Builds upon others ideas Integrates information and ideas from varied sources to create new solutions		Conveys openness to new ideas Is comfortable dealing with open-ended problems Encourages "out of the box" thinking Supports the ideas and viewpoints of others
Team Decision-making	**Knowledge**	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Valuation**
Judgment / Using facts: Reaching conclusions based upon clear analysis of facts and ideas	Recognizes tools and techniques for making judgments	Accurately describes how to use techniques for making judgments (fishbone, narrowing, histograms)	Makes decisions based upon facts rather than "gut-feel" or intuition -Discourages team members from rushing to	Establishes objective criteria against which to evaluate alternatives Accurately analyzes trends and patterns in order to	Seeks solutions that satisfy multiple criteria	Evaluates alternatives in relation to objective criteria	

			conclusions Presses team members for facts to support decisions	reach conclusions			
Reaching Consensus: Ensuring buy-in and commitment to decisions reached	Defines consensus-based decision-making	Distinguishes consensus-based decision-making from other forms of decision-making	Seeks buy-in from all team members before finalizing decisions Polls team members for their opinions Listens to the opinions and feelings of other team members Does not pressure others into accepting decisions Accurately determines when to use consensus decision-making and when not to	Considers alternatives from several points of view	Alters solutions so that all can support it	Employs a devil's advocate to evaluate pros and cons of alternatives	Is sensitive to others body language and or other non-verbal signs of agreement/disagreement
Self-Management	**Knowledge**	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Valuation**
Establishing directions and standards: Helping create plans and structure for the team		Describes how to use planning tools (e.g. goal setting, Gantt charts)	Establishes task priorities Clearly states expectations regarding performance Keeps the team	Helps clarify conflicts regarding roles and responsibilities Reconciles conflicting priorities	Formulates action plans and timetables Creates strategies and plans of action	Evaluates team performance (task) relative to objectives	Celebrates team and individual accomplishments Is comfortable attending to several issues at the same time

			focused Records milestones and accomplishments				
Managing meetings: Using principles of effective team meetings	Defines a Working Agreement	Describes the components of an effective team meeting	Discourages side-conversations and or getting off track during discussions Helps manage time during meetings Assists in note taking / recording meeting minutes	Helps monitor meeting progress and effectiveness	Helps team develop a working agreement	Evaluates team performance (process) relative to its working agreement	
Personal conduct: Demonstrating personal responsibility to the team and respect for team members		Understands what one must do to be effective in a team setting	Follows through on commitments Is prompt for meetings and appointments Does not criticize others behind their backs Is flexible and adapts to demands of situations and constraints Maintains an appropriate balance between listening and speaking	Differentiates between team membership and team leadership	Knows when to assume a leadership role and when to let others assume that role		Supports shared leadership amongst team members Treats others with courtesy and respect Conveys enthusiasm and support for others, especially when the team is under stress Does not "point fingers" or blame others when things go wrong Shares accountability for team results

Outcome E: Graduates have the ability to identify, formulate, and solve engineering problems

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome Element: Challenges the way things are being done	Defines facts about current processes and procedures.	Identifies and understands all problems associated with current methods.	Uses knowledge to compute possible undesirable outcomes.	Identifies and analyzes key areas where improvements can be made.	Creates new alternatives by combining knowledge and information.	Evaluate current practices to determine their efficiency and/or value.	Uses personal value system to challenge methods used to solve engineering problems.
Outcome Element: Improves on what has been done before	Provides a list of possible alternatives.	Recognizes the positive and negative aspects of each of the alternatives.	Uses knowledge and information to change current processes and procedures.	Can compare and contrast previous practices versus proposed improvements.	Reconstructs current practices integrating improvements where needed.	Appraises each alternative with respect to the others, including the option not to make a change.	Uses knowledge and information to challenge past practices for continuous improvement. Actively seeks new opportunities, ideas, for continuous improvement.
Outcome Element: Generates many potential solutions to a given problem	Identifies and lists new alternatives to solve engineering problems.	Describes and understands the engineering problem to be solved.	Demonstrates ability and uses knowledge, information, and skills, to produce many alternatives to solve an engineering problem.	Identifies and analyzes potential solutions to an engineering problem.	Can create and explain potential solutions to an engineering problem.	Uses judgment to evaluate the many alternatives to solve an engineering problem.	Defends and supports potential solutions to solve an engineering problem.
Outcome Element: Suggests new approaches to solving problems.	Can identify the value of the perspectives of other people in relation to solving an engineering problem.	Can describe new ideas in relation to how an engineering problem should be solved.	Uses knowledge to compute possible new approaches. Generates innovative methods to solve problems.	Examines new approaches to gain an understanding of which approach should be used to solve an engineering problem.	Set-up a relation between an engineering problem and the new approaches developed to solve it.	Can assess the effectiveness of each approach.	Willingness to accept the perspectives of others as input when creating new approaches for solving engineering problems.

Outcome Element: Discourages others from rushing to conclusions without facts.	Lists the facts that the user can be certain of. Recognizes the importance of using facts to solve engineering problems.	Understands and describes why facts are key to solving engineering problems.	Uses facts to solve engineering problems and employs others to do the same.	Separate facts from assumptions.	Generates facts to support conclusions when solving engineering problems.	Evaluates why decisions are made for validity.	Motivates others to justify decision-making with information and data. Defends solving problems with facts. Challenges the reason behind the conclusion.
Outcome Element: Handles unknowns or open-ended questions effectively.	Defines what the user knows and does not know.	Indicates where information is needed.	Uses proper technique to answer questions that are unknown or open-ended.	Asks questions to gain knowledge in areas that are unknown.	Manages known information to formulate the answer to unknown and open-ended questions.	Uses appropriate skills and techniques to estimate the answer to unknown and open-ended questions.	Respects and accepts the impact of answering questions where the user does not have a sufficient knowledge base.
Outcome Element: Demonstrates openness to new ideas.	Can identify the value of the perspectives of other people's ideas in relation to solving an engineering problem.	Recognizes the importance of receiving new ideas to solve engineering problems.	Uses knowledge to demonstrate an openness to apply new ideas to solve engineering problems.	Can compare and contrast new ideas versus existing ideas.	Collects new idea information from multiple sources.	Can assess the effectiveness of each new idea. Can judge new concepts fairly.	Shows a willingness to use the perspective and ideas of others. Supports the generation of new ideas to solve an engineering problem.
Outcome Element: Demonstrates the ability to apply theoretical concepts to practical problem solving.	Can identify applicable theory and recognize past history when solving practical engineering problems.	Can indicate how theory can be applied in practice.	Can use theoretical concepts to develop solutions to solve practical engineering problems.	Can breakdown theory concepts and analyze their relationship to solving practical engineering problems.	Relates theoretical concepts to practical problem solving.	Can interpret results using theoretical concepts as supporting evidence.	Values and accepts the limitations of using theory concepts. Supports using theory to solve practical engineering problems.

Outcome Element: Uses appropriate resources to locate pertinent information.	Can recall appropriate resources to utilize to obtain information.	Understands what resources to use to locate information for problem solving.	Uses resources adequately to obtain information. Demonstrates knowledge of appropriate resources to use.	Identifies and selects appropriate resources needed to gather information.	Collects a list of resources to gather information necessary to solve the problem at hand.	Appraises information resources needed to gather information.	Can accept the quality and relevance of information from a source to gather information.
Outcome Element: Estimates Outcomes.	Can list and describe various outcomes for solving engineering problems.	Can describe and defend alternatives to estimate outcomes.	Applies knowledge of information and data with respect to alternatives to predict outcomes.	Analyzes, and calculates outcomes to engineering problems.	Collects possible outcomes to a given engineering problem.	Can interpret the given information and predict possible outcomes.	Can support and defend predicted outcomes.
Outcome Element: Compares calculations to estimates to check for errors.	Can recognize errors when comparing the estimate to the final calculation.	Identifies calculation errors when comparing the estimate to the final calculation.	Uses mathematical skills to discover errors associated with the estimate and the final calculation.	Can compare results to estimates to identify errors.	Relates calculation results to estimations to verify data.	Can evaluate calculations to see if the solutions adhere to expected values/units.	Questions calculations when comparing to estimates for support.
Outcome Element: Develops criteria for the evaluation of proposed solutions.	Can define and list key components that a proposed solution should consider.	Can create and classify criteria used to evaluate proposed solutions.	Demonstrates knowledge of engineering principles necessary for developing criteria.	Can categorize information into criteria for the evaluation of proposed solutions.	Construct a list of criteria that addresses the problem and for the solutions to adhere to.	Can generate criteria necessary to make judgments about proposed solutions.	Defend the ability of the criteria to represent key information to a proposed solution.
Outcome Element: Constructs a problem statement.	Can define and outline problem variables and information given, to construct a problem statement.	Uses the principles and theories of engineering to clearly define a problem statement.	Uses information and knowledge to construct a problem statement effective for problem solving.	Can analyze the problem variables to develop a problem statement.	Combine and relate problem variables into a problem statement.	Selects information useful in constructing a problem statement.	Challenge current situation to determine flaws that can be improved on. Support problem statement as to its ability to generate possible solutions in the key areas to improve the situation.

Outcome Element: Generates ideas for possible solutions.	Recalls on past experience as a foundation for identifying new ideas.	Can create and describe new ideas to be used for solving engineering problems.	Uses knowledge and information to produce many ideas for possible solutions to solve engineering problems.	Can analyze and identify ideas that can be used to solve engineering problems.	Generate a list of ideas that can contribute to possible problem solutions.	Evaluate solutions on their ability to solve a given problem.	Shows a willingness to use the perspective and ideas of others. Supports the generation of new ideas to solve an engineering problem.
Outcome Element: Selects most appropriate solutions based on solution criteria.	Can list all possible solutions and solution criteria.	Can explain and select the "best" solution using a set of criteria.	Uses knowledge, information and skills to select the "best" solution based on a set of criteria.	Has the ability to compare and to contrast solutions to select the "best" based on a set of criteria.	Assemble a collection of solutions that adhere to the given solution criteria.	Chooses the "best" solution based on the solution criteria by using all of the evidence for support.	Question solutions on how they adhere to the necessary criteria.
Outcome Element: Selects and documents the solution to be recommended.	Selects most appropriate solution based on criteria.	Can explain and describe in writing the engineering problem solution.	Demonstrates knowledge of the engineering problem to be solved. Can choose and write problem solution description.	Can compare and contrast solutions to select the "best" solution. Can illustrate in writing the solution to be recommended.	Prepare and write documentation that recommends and explains a solution.	Uses facts when selecting solution to engineering problem. Provides detailed documentation of the recommended solution.	Accept and support chosen solutions.
Outcome Element: Collects feedback for continuous improvement.	Ability to identify suitable sources of useful feedback.	Recognizes the importance obtaining feedback from others for continuous improvement.	Obtains and documents feedback of others for continuous improvement.	Can analyze feedback to select the appropriate feedback that can be used for continuous improvement.	Compose a list of positive feedback that can lead to future improvement.	Evaluate feedback to determine if useful for future improvements.	Respects both positive and negative feedback that contribute to further improvement.
Outcome Element: Uses a basic knowledge of social sciences in the formulation of problem solutions.	Relates social science knowledge when formulating an engineering problem solution.	Has basic knowledge and understanding of the social sciences with respect to forming engineering problem solutions.	Can apply social science knowledge when forming engineering problem solutions.	Can relate the basic knowledge of social sciences to formulate engineering problem solutions.	Relates social science knowledge to formulate engineering problem solutions.	Justify problem solutions with knowledge of social sciences.	Defends own background and knowledge in social sciences.

Outcome Element: Applies basic knowledge of management to problem solving.	Describes the responsibilities of management, and relates it to problem solving.	Has basic knowledge of management techniques and applications.	Can apply basic management knowledge towards solving engineering problems.	Can relate the basic knowledge of management to solve engineering problems.	Relates management knowledge to engineering problem solving.	Appraise solutions from a managerial point of view.	Defends own managerial skills and knowledge when solving problems.
Outcome Element: Uses appropriate resources to locate pertinent information.	Can define and describe resources needed to locate information. Can list where to find the resources and how they are used.	Understands what resources to use to locate information for problem solving.	Uses information and knowledge to construct a problem statement effective for problem solving.	Identifies and selects appropriate resources needed to gather information.	Collects a list of resources to gather information necessary to solve the problem at hand.	Appraise information resources needed to gather information.	The user can accept the quality and relevance of information from a source to gather information.
Outcome Element: Estimates outcomes.	Can list and describe various outcomes for solving engineering problems.	Can describe and defend alternatives to estimate outcomes.	Applies knowledge of information and data with respect to alternatives to predict outcomes.	Analyzes, and calculates outcomes to engineering problems.	Collects possible outcomes to a given engineering problem.	Interpret the given information and predict possible outcomes.	Support and defend predicted outcomes.
Outcome Element: Compares calculations to estimates to check for errors.	Can recognize errors when comparing the estimate to the final calculation.	Identifies calculation errors when comparing the estimate to the final calculation.	Uses mathematical skills to discover errors associated with the estimate and the final calculation.	Can compare results to estimates to identify errors.	Relates calculation results to estimations to verify data.	Uses mathematical skills to discover errors associated with the estimate and the final calculation.	Questions calculations when comparing to estimates for support.
Outcome Element: Develops criteria for the evaluation of proposed solutions.	Can define and list key components that a proposed solution should consider.	Can create and classify criteria used to evaluate proposed solutions.	Demonstrates knowledge of engineering principles necessary for developing criteria.	Can categorize information into criteria for the evaluation of proposed solutions.	Construct a list of criteria that addresses the problem and for the solutions to adhere to.	Can generate criteria necessary to make judgments about proposed solutions.	Defend the ability of the criteria to represent key information to a proposed solution.
Outcome Element: Constructs models of physical systems, which incorporate	Can define methods of information gathering to acquire an accurate estimate.	Can classify and identify useful methods of information gathering for the	Uses knowledge to construct models of physical systems.	Analyze and examine individual components of the physical system and determine the	Generate a model of a physical system within an acceptable order of magnitude.	Appraise the accuracy of the model against an actual physical system that it is	Accept the determined orders of magnitude and accuracy to provide a model

those effects necessary to achieve the required accuracy by correctly estimating appropriate magnitudes for parameters and inputs.		physical system model.		appropriate accuracy needed.		simulating.	that simulates a physical system.
Outcome Element: Applies the appropriate "conservation" principles of total mass, linear momentum, angular momentum, energy, and charge to model physical systems.	Can relate principles of physics to engineering problem solving.	Can predict the behavior of a system in terms of the physical properties of particles and energy.	Uses knowledge of the principles of total mass, linear momentum, angular momentum, energy, and charge to model physical systems.	Break down the physical system in terms of mass, linear momentum, angular momentum, energy and change.	Explain the physical model as a whole, adhering to the basic principles of physics and conservation.	Evaluate calculations to insure the laws of conservation are held.	Question calculations to whether they adhere to the laws of conservation.
Outcome Element: Applies the principles of the 2nd law of thermodynamics to predict upper bounds on the performance of thermodynamic cycles.	Can relate the principles of the 2nd law of thermodynamics to engineering problem solving.	Can estimate a physical system's performance and efficiency with the second law of thermodynamics.	Demonstrates and applies knowledge of the principles of the 2nd law of thermodynamics to predict upper bounds on the performance of thermodynamic cycles.	Determine those components of the physical model that can be analyzed with the second law of thermodynamics.	Explain the physical model as a whole to determine the upper bounds on performance of thermodynamic cycles, adhering to the second law of thermodynamics.	Evaluate calculations to insure the second law of thermodynamics is held.	Question calculations to whether they adhere to the second law of thermodynamics.
Outcome Element: Judges, interprets, and explains the results of modeling by relating the results to the fundamental laws of physics.	Can relate the results of the physical model to the fundamental laws of physics.	Can summarize the results of a physical model and it's relation to the fundamental laws of physics.	Interpret the results of modeling in terms of the fundamental laws of physics.	Identify the results of modeling that relate to the fundamental laws of physics.	Summarize the results of physical modeling and the applicable principles of physics.	Judges, interprets, and explains the results of modeling by relating the results to the fundamental laws of physics.	Challenge and question a physical model in terms of its physical traits.

Outcome Element: Applies the appropriate principles of chemistry to model engineering systems.	Can relate the principles of chemistry to model engineering systems.	Can explain the chemical properties of the engineering system model.	Illustrate an engineering system using the principles of chemistry.	Distinguish the applicable properties of chemistry to analyze the engineering system.	Uses the principles of chemistry where appropriate to model engineering systems.	Interpret the data from an engineering system and how it relates and adheres to the principles of chemistry.	Question those areas where the laws of chemistry apply in an engineering system.
Outcome Element: Makes appropriate and necessary chemical-related assumptions for parameters and inputs to enable models to provide the required accuracy.	Can identify which assumptions can be made safely without damaging the integrity of the data.	Can estimate the necessary chemical-related parameters and inputs for engineering system models.	Uses knowledge of chemistry to make accurate assumptions.	Analyze each parameter and input to the engineering system to determine the needed accuracy.	Formulate a list of chemical-related assumptions to feed into the engineering system.	Appraise each chemical-related assumption to yield the desired result.	Question each assumption to check if it supports the engineering model. Support the chemical-related assumptions that have been made.
Outcome Element: Applies the principles of chemistry to account for species mass in engineering systems.	Relates the principles of chemistry to account for species mass in engineering systems.	Can describe and explain species mass in engineering systems with chemical principles.	Uses knowledge of chemistry to compute mass in engineering systems.	Analyze species mass using the principles of chemistry in engineering systems.	Combine the necessary principles of chemistry to analyze species mass in engineering systems.	Describe species mass in an engineering system with the fundamental principles of chemistry.	Accept or question species mass and its explanation or justification with the principles of chemistry.
Outcome Element: Interprets and explains the results of modeling based on the fundamental laws of chemistry.	Can relate the results of the physical model to the fundamental laws of chemistry.	Can explain and report the details of the results of modeling based on the fundamental laws of chemistry.	Applies knowledge of the fundamental laws of chemistry to analyze the results of the physical model.	Contrast individual results from modeling to the fundamental laws of chemistry.	Uses the fundamental laws of chemistry to support the evaluation of the results of modeling.	Evaluate results of an engineering model and compares them to the fundamental laws of chemistry.	Question the results of an engineering model and how they adhere to the fundamental laws of chemistry.
Outcome Element: Demonstrates knowledge of the	Can relate the results of the physical model to mathematics.	Can describe the relation between the physical model and the underlying	Uses mathematics knowledge as a tool when modeling systems.	Relate the role of mathematics in modeling physical and engineering	Relate the role of mathematics in modeling engineering	Interpret an engineering model with mathematical theory and	Support an engineering system model with mathematical

role of mathematics as a tool in modeling systems.		mathematical principles.		systems.	systems.	principles.	theory.
Outcome Element: Demonstrates understanding of functional relationships.	Can relate different mathematical functions to each other.	Estimate the outcomes of functions based on the behavior of other functions.	Can manipulate functions to solve for other relative functions.	Examine the properties of functional relationships.	Generates a series of relevant functions to an engineering model and relates them to one another.	Interpret the meaning of the relationships between functions.	Accept functional relationships where they occur in generating engineering models.
Outcome Element: Distinguishes between change, rate of change, and integrals of functions.	Can recall basic knowledge of calculus.	Can classify change, rate of change and integrals of functions. Can describe the differences and similarities between each.	Can compute and solve basic calculus problems.	Distinguish the individual qualities and properties of change, rate of change and integrals.	Formulate elementary principles of calculus in modeling engineering systems.	Contrast the concepts of change, rate of change and integration from calculus.	Accept and defend the individual roles change, rate of change and integration play in mathematics.
Outcome Element: Constructs and solves a mathematical model that is appropriate for the accuracy required.	Can state appropriate hypothesis and theorems to create mathematical models.	Can explain the relevance of the hypothesis and theory to the mathematical model.	Produce results from a mathematical model that has the needed accuracy.	Can break down components of a mathematical model, and analyze each section independently.	Can assemble and synthesize individual components to solve a mathematical model with accuracy.	Appraise and evaluate the level of accuracy of a mathematical model.	Defend and support or question and challenge a mathematical model's level of accuracy.
Outcome Element: Makes appropriate and necessary mathematics-related assumptions to enable models to provide the required accuracy.	Can recall basic mathematical and statistical knowledge to support assumptions made to achieve accuracy.	Understands the mathematics-related assumptions to enable models to provide the required accuracy.	Use mathematical knowledge to make assumptions about an engineering model.	Distinguish the needed levels of accuracy in the various areas of an engineering model.	Construct and propose mathematical assumptions to generate the required accuracy.	Assess and judge assumptions to see if they support the needed accuracy.	Accept and support the mathematics-related assumptions generated.
Outcome Element: Judges, interprets	Can define and describe the results of engineering	Can employ the mathematical knowledge needed	Interpret mathematical aspects of an	Examine each of the results from an engineering system	Summarize the results of engineering systems	Judges, interprets, and explains the results of modeling	Challenge and question a engineering model

and explains the results of engineering systems that are due to the mathematics employed.	systems by recalling mathematical knowledge.	and express how it relates to the engineering system.	engineering system's results.	in terms of its mathematical properties.	and the applicable principles of mathematics.	by relating the results to the principles of mathematics.	in terms of its mathematical traits.

Outcome F: Graduates have an understanding of professional and ethical responsibility

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome Element: Demonstrates an ability to make informed ethical choices		User can identify concrete facts from intangible assumptions in a given situation.	When making an informed ethical decision the user can: Use knowledge to identify specific information to consider; use knowledge to identify the impacts (short-term and long-term); use the perspectives of other people; use knowledge to gain information.	User can separate facts from assumptions in order to distinguish where more information is needed.	The newly acquired facts are then collected and combined with the information surrounding the ethical decision being made.	Defend the newly acquired information in terms of their validity to support the ethical decision being made.	Defend the ethical decision being made with the support of factual components.
Outcome Element: Demonstrates knowledge of a professional code of ethics	User can identify the codes of conduct that a professional engineer should behave by.	User can describe their professional code of ethics; identify and characterize one different from their own; has a general knowledge of the impacts.	Shows knowledge of a professional code of ethics when considering possible alternatives during decision-making.	Can identify and analyze components of a decision independently of each other in terms of ethical guidelines.	Relates components of an ethical decision together in order to abide by their professional code of ethics.	Evaluate and judge a situation and possible further actions in terms of their professional code of ethics.	Uses personal value system to challenge others to use a professional code of ethics during decision-making.
Outcome Element: Evaluates the ethical dimensions of professional engineering and scientific practice	Can identify and define ethical issues concerning a decision, which can impact the individual, the company and the public.	Can describe ethical issues and how they effect the individual, the company and the public.	Can apply ethics when practicing engineering or science in a professional environment.	Can identify cost, schedule and risk components in terms of ethics when evaluating professional engineering and scientific practice.	Can combine cost, schedule and risk components together to make an informed ethical decision.	User can evaluate the value and credibility of information and their sources to make sound judgements.	User questions decision solely based on facts versus incorporating the ethical impacts the decision can have on the individual, the company and the public.

Outcome Element: Demonstrates ethical practice	Uses information to identify knowledge gaps. User can recognize the cost, schedule and risk components in terms of ethical issues.	User can integrate and describe ethical components used in practice (cost, schedule and risk) along with their professional code of ethics.	Uses knowledge, information, and the perspectives of other people to evaluate all of the impacts (short-term and long-term) when performing the task of making an ethical decision. Practices team concepts.	Can identify where knowledge is needed for competency, communication of information in a responsible manner, and the awareness of public safety concerns.	Can combine ethical components in terms of behavior (competence, responsibility, and public safety) of an ethical decision together to make an informed ethical choice.	Evaluate and judge a situation in practice, using facts and a professional code of ethics.	Uses personal value system to support actions. Accept and/or challenges standards.

Outcome G: Graduates have the ability to communicate effectively

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome Element: Communicates information, concepts, and ideas effectively in writing	Identifies and repeats standard formats; recalls and reproduces standard grammar and mechanics; recognizes elements of the writing process	Summarizes and paraphrases accurately; classifies various audiences and purposes	Employs the writing process; produces a variety of documents using appropriate formats, grammar, and mechanics; uses discipline-specific conventions	Analyzes and criticizes arguments effectively; selects and uses appropriate style and content for various audiences and purposes	Constructs a logical argument using evidence for support; designs, writes and revises documents appropriate for various audiences and purposes	Argues effectively using evidence; evaluates one's own and others' logic and organization; selects appropriate format, content, organization, and tone for various audiences and purposes	Has confidence using writing as a communication tool; appreciates the role writing plays in one's academic and professional careers; respects writing as a learning and thinking tool
Outcome Element: Orally communicates information, concepts, and ideas effectively	Recalls and repeats information in oral presentations, often from memory; has difficulty responding to questions	Paraphrases or summarizes information in oral presentations; restates and/or gives examples when questioned	Uses appropriate presentation techniques (e.g. Maintains eye contact, modulates voice, does not use distracting gestures, etc.); uses process strategies to prepare presentations	Outlines and selects appropriate material to include in oral presentation depending on analysis of audience and purpose; analyzes and appraises when questioned	Plans, prepares and delivers a well-organized, logical oral presentation; reconstructs, explains when questioned	Listens carefully and responds to questions appropriately; is able to explain and interpret results for various audiences and purposes	Has confidence in using oral presentations as a communication tool; appreciates the role oral communication plays in one's academic and professional careers
Outcome Element: Graphically communicates information, concepts, and ideas	Recognizes and duplicates graphics conventions	Selects and restates graphics conventions	Uses professional graphics in written and oral presentations; uses appropriate graphics conventions (e.g. Formats, captions, titles, axes, legends, etc.)	Analyzes data using graphical techniques; illustrates concepts using graphics; identifies appropriate uses of graphics in written and oral presentations	Creates effective professional graphics for a variety of audiences and purposes; explains complex concepts through graphics	Argues effectively using graphics; uses graphics to explain, interpret, and assess information; evaluates graphical arguments based on logic, evidence, and presentation	Has confidence in using graphics as a communication tool; appreciates the role graphics plays in one's academic and professional careers.

Outcome Element: Can acquire and use information from a variety of sources, including electronic retrieval systems	Identifies various information sources	Summarizes and reports information accurately	Gathers information from a variety of sources; uses information to produce technical reports and solve problems	Analyzes information; tests the credibility of information sources; selects state-of-the-art information in his/her discipline	Concisely and precisely summarizes and synthesizes information	Reads critically and evaluates the credibility of information sources including the effectiveness of claims and supporting evidence; discriminates between various audiences and purposes and designs communications appropriate for them	Values the ability to retrieve and use information; has confidence in his/her ability to retrieve, use, and evaluate information

Outcome H: Graduates have the broad education necessary to understand the impact of engineering solutions in a global and societal context

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome Element: Understand the impact of engineering solutions in a global context Global meaning to cross cultures and societies, example areas of impact include, but not limited to, environmental, political, and economic.	Can define key terms associated with understanding global issues. Lists the steps in a method for identifying impacts of an engineering solution that crosses cultures or societies. Can name sources of global impact knowledge. Describes how nations and peoples around the globe are related. Can recall the impacts of several engineering solutions, recent and historical, and their anticipated and unanticipated impacts Student can identify a variety of types of impacts for a engineering solution (i.e. environmental, political,	Can describe situations where society has become more global. Can explain an illustration of how modern technologies have had a global impact (e.g. chemicals in environment, telecommunications). Can classify types of impacts an engineering solution in a global context. Can recognize examples where solving one engineering problem led to the development of other engineering-related problems (ex. development of nuclear energy to reduce depletion of oil results in increased nuclear waste; development of antibiotics to help reduce bacterial infections results in an evolution of more	Can identify potential impacts, both short and long term, of an engineering solution currently being proposed. Uses knowledge about the interrelationships of peoples and environments around globe to identify impacts of engineering solutions. Identifies the relevant groups of people and environmental systems that need to be considered when evaluating an engineering solution.	Appraises the actual impacts of an engineering solution into the appropriate impacts	Summarizes the interrelated aspects of engineering solutions Incorporates gained knowledge of potential and actual impacts into the design process of an engineer.	Can assess conflicting / competing tradeoffs in order to make informed decisions about engineering solutions. Judges the acceptability of the impacts of an engineering solution	Respects the historical aspects of engineering solutions and their impacts. Actively seeks knowledge of the world events which his/her engineering activity likely affects

	economical). Can identify criteria to be considered when an engineering solution has a global presence (e.g., language issues, different safety standards, etc.)	resistant strains of bacteria)					
Outcome Element: Understand the impact of engineering solutions in a societal context Societal – meaning issues associated with the groups of people and their beliefs, practices and needs	Can describe the key features characterizing an individual perspective Can identify a variety of practices, methods that others use Can define key terms associated with understanding societal context Can identify milestones in the evolution of current society, global society. Can state differences in needs that result from diversity in society Can state ways in which modern society is diverse. Can identify	Can identify and characterize different perspectives (beliefs, practices, etc.). Can compare various practices/perspectives to identify similarities and differences. Can describe the role that science, technology and engineering has played in the development of modern society. Can describe how ideas and customs from other cultures have contributed to the engineering discipline and/or modern society.	Can explain engineering conflicts in terms of differences of perspectives. Can identify alternative mechanisms for solving a given problem. Can use knowledge to identify impacts of an engineering solution Can use knowledge of the ways in which ideas and customs from other cultures have contributed to modern life in order to support the identification of the impact of engineering solutions. Can identify the key attributes of perspective different	Appraises the failure of an engineering solution and investigate the role that unanticipated impacts played in the failure of the solution. Can appraise alternative mechanisms for solving a conflict of a society's perspective.		Can critically evaluate the strengths and weaknesses of their own perspectives Can assess conflicting / competing tradeoffs in order to make informed decisions about engineering solutions. Judges the acceptability of the impacts of an engineering solution	Actively seeks knowledge of society in which his/her engineering activity is situated Accepts perspectives different from their own.

	different facets by which an engineered solution impacts modern society (e.g. aesthetics, religion, economics) Can name sources of societal impact knowledge.		from their own.				

Outcome I: Graduates have a recognition of the need for, and an ability to engage in life-long learning

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome element: Demonstrates reading, writing, listening and speaking skills	Ability to list the skills necessary for reading, writing, listening, and speaking.	Ability to give examples of where the skills for effective reading, writing, listening, and speaking lead to success in life.	Ability to apply the skills necessary for reading, writing, listening, and speaking to each situation (i.e. School, job, everyday life).	Ability to analyze how the skills facilitate the communication process.	Ability to develop and organize the skills necessary for reading, writing, listening, and speaking in order to take in information and express it to others in a comprehensive manner.	Ability to evaluate the effectiveness of the skills necessary for reading, writing, listening, and speaking as it relates to the communication process.	
Outcome Element: Demonstrate an awareness of what they need to learn	Identify the tools needed in order to conduct research and develop independent learning skills	Explain how awareness of what has been learned will enhance research and independent learning skills	Apply what has been learned to an actual project	Examine what has been learned and point out how learning relates to project outcome	Integrate learning outcomes	Assess the impact awareness has on the amount and quality of learning	
Outcome Element: Following a learning plan	Define the elements that go into developing a learning plan	Select elements of the learning plan and describe them	Apply the learning plan to an actual research project or independent learning opportunity	Analyze the learning plan for effectiveness	Develop a learning plan	Evaluate alternative learning plans for future projects	
Outcome Element: Identifying, retrieving, and organizing information	Recall previously learned information	Discuss the meaning of the information	Use the information learned in actual situations	Identify how the information is interrelated	Organize the information categorically	Judge the information based on various criteria	
Outcome Element: Understand and remember new	Memorize new information	Convert the new information into own personal mode of understanding	Apply the new information to an actual situation	Compare and contrast new information with previously learned information	Integrate new information with previously existing information	Summarize and evaluate integrated information	

information							
Outcome Element: Demonstrate critical thinking skills	Memorize facts, formulas, theories, etc	Explain facts, formulas, theories, etc. In own words	Apply the facts, formulas, theories, etc. To everyday situations	Question the meaning behind the facts, formulas, theories, etc.	Synthesize all of the facts, formulas, theories, etc. Into a comprehensive way of understanding	Assess extent of understanding of skills and ability to use them	
Outcome Element: Demonstrate ability to reflect on own understanding	Recall own understanding of information learned	Identify the ways in which information is learned	Illustrate how information is applied in various situations	Analyze how well material is being learned and understood	Modify mental strategies for better understanding	Evaluate thinking skills	

Outcome J: Graduates have a knowledge of contemporary issues

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome Element: Ability to address the major socio-economic issues facing US and world	List and describe the major socio-economic issues; e.g., global warming; over population; depletion of natural resources; energy and water supplies; nuclear waste and proliferation; environmental pollution; disease; trade; human rights, etc. Have study abroad experience	Able to discuss, in-depth, several of these issues; summarize cogent aspects; recognize consequences; take and defend a position.	Able to examine a specific area, country or scenario relative to one or more of these issues; able to discuss implications.	Ability to analyze an issue from a "systems" perspective; develop a model or abstraction of the situation; make and defend simplifying assumptions; exercise model to draw inferences to assist in decision making.	Ability to design a system or strategy that addresses a particular issue in a given scenario or location. Ability to propose out-of-the-box alternatives; formulate alternative solutions.	Able to evaluate alternative solutions, or scenarios using a series of different measures –e.g., economic, quality of life; number of individuals affected; global ramifications; etc.	Accepts limitations of solutions; appreciation of differences between alternatives; understands the qualitative dimensions of the problems; can view from different perspectives.
Outcome Element: Ability to address political issues at nation, state and local levels.	Can list and describe major political issues at national, state and local levels. Can list major candidates – senators, representatives, governors, mayors and describe their positions on important issues.	Able to discuss in-depth major political issues at national, state and local levels. Can summarize essence of several issues; take and defend a position on them.	Able to examine the ramifications of one or more of these issues on a specific population or cohort.	Ability to analyze a political issue from a "systems" perspective; develop a model or abstraction of the situation; make and defend simplifying assumptions; exercise model to draw inferences to assist in decision making.	Ability to design a system or strategy that addresses a particular political issue relative to a given scenario or location.	Able to evaluate alternative political solutions, or scenarios using a series of different measures –e.g., economic, quality of life; number of individuals affected; political ramifications; etc.	Accepts limitations of political solutions; appreciation of differences between alternatives; understands the qualitative dimensions of the problems; can view from different perspectives.

Outcome K: Graduates have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Taxonomy Level:	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Valuation
Outcome Element: Use modern engineering techniques, skills, and tools such as computer software, simulation packages, and diagnostic equipment.	Lists available techniques, skills, and tools available to a specific engineering discipline.	Classifies the role of each technique, skill, and tool in solving engineering problems, studying the performance of existing processes or systems, and/or developing designs.	Uses engineering techniques, skills, and tools including computers to solve engineering problems. Uses engineering techniques, skills, and tools including computers to monitor performance of engineering systems and/or create engineering designs. Uses engineering techniques, skills, and tools to acquire information needed for decision-making.	Compares results from computer software or simulators with system performance or results from alternative calculation methods including heuristics. Selects appropriate techniques and tools for a specific engineering task.	Combines the use of two or more tools and techniques to solve an engineering problem or develop an engineering design. Combines use of engineering tools plus system operating information to find optimal operating conditions. Combines results from heuristic calculations, graphical analysis, and computer simulation to support decision-making.	Evaluates which techniques or tools are most appropriate to complete a specific engineering task. Compares results from several engineering tools to determine which best explains "reality."	Accepts the utility and limitations of engineering tools to solve problems or create engineering designs.