

Appendix I – Scorecards for Program Outcomes *a* through *k*

Table I.1 Scorecard for program outcome *a*

An ability to apply knowledge of science, mathematics and engineering					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria					
CONCEPT 1: Knowledge of mathematics					
Uses appropriate mathematics to formulate and solve engineering problems	Formulation is riddled with mistakes, unable to solve problems, or uses inappropriate mathematics	Formulates and solves using somewhat appropriate mathematics but with numerous errors	Formulates and solves using mostly appropriate mathematics with few mistakes	Correctly formulates and solves engineering problems using appropriate mathematics without mistakes	
CONCEPT 2: Knowledge of science					
Applies appropriate scientific laws and associated equations to solve engineering problems	Uses few appropriate laws and equations	Uses some appropriate laws and equations with numerous errors	Uses mostly appropriate laws and equations with few mistakes	Uses appropriate laws and equations correctly	
CONCEPT 3: Knowledge of engineering					
Applies appropriate knowledge and principles of engineering to analyze civil engineering systems	Applies few relevant engineering principles - many flaws in analysis	Applies some relevant engineering principles - some flaws in analysis	Applies mostly relevant engineering principles - few flaws in analysis	Applies all relevant engineering principles correctly	

Table I.2 Scorecard for program outcome *b*

Ability to design and conduct experiments, as well as to analyze and interpret data					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria	CONCEPT 1: Experimental Procedures				
Conducts an experiment to appropriate test standards	Performs experiments such that results are meaningless	Does not follow test standard procedures, but results are acceptable	Performs test in accordance with most standard procedures	Conducts experiments in compliance with test standards	
	CONCEPT 2: Analysis and Interpretation				
Data interpretation	Incorrectly interprets data collected during experiment	Major errors in data interpretation	Minor errors in data interpretation.	Applies relevant engineering principles to interpret data correctly	
Comparisons between theoretical and experimental results	No comparison or severely flawed comparison.	Graphical representation of comparison, but limited discussion	Graphical comparison and discussion, but with minor flaws	Good comparison and discussion, explaining differences, possible errors, etc.	
Conclusions	Draws no conclusions	Some conclusions, but with errors	Only minor errors in conclusions drawn from results of the experiment	Appropriate conclusions based on experiment and theoretical results	

Scorecard for program outcome *c* used in CEE 490

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					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria					
CONCEPT 1: Utilizes Design Process Elements					
Define design problem and project scope	Incomplete understanding of project; scope not well developed	Project understood and defined; project scope defined but not detailed	Project well defined/understood; project scope defined by tasks with timeline	Project clearly defined/understood; project scope defined by detailed tasks and subtasks with accurate timeline that meets all project objectives	
Synthesize and evaluate alternative solutions	No alternatives considered or only cursory consideration without reasonableness test	Generates at least two reasonable alternatives and considers needs	Generates multiple reasonable alternatives; considers factors such as needs and costs to determine best alternative	Generates multiple effective alternatives; explains and uses an evaluation system which explicitly uses multiple relevant factors to determine recommended alternative	
Incorporate regulations, codes, and safety	Cursory consideration of codes and safety without documentation	Regulations and codes incorporated mostly correctly but not well documented	Regulations and codes incorporated, safety considered, compliance documented fairly well	Regulations, codes, and safety considered and incorporated throughout design, compliance thoroughly documented	
CONCEPT 2: Estimation of Engineering Costs					
Engineering fees for design work	Provides lump-sum engineering fees without detailed basis	Provides fees by task and job category without details	Develops engineering fees by task, and hours for all personnel including overhead charges and subcontractors	Provides detailed fee estimate based on tasks performed, hours for each task by duty, considers overhead, other direct charges and subcontractor fees by task	

Table I.4 Scorecard for program outcome *d*

An ability to function on multi-disciplinary teams					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria					
CONCEPT 1: Makes contributions					
Information gathering, calculations, presentations, reports	Gathered some information, performed few calculations, worked on presentations and reports inconsistently or very little	Gathered some information, performed some calculations, worked on presentations and reports inconsistently	Gathered information, performed calculations, worked on presentations and reports consistently as assigned	Gathered information, performed calculations, led work on presentations and reports consistently	
CONCEPT 2: Takes responsibility					
Reliability, timeliness, attendance, deadlines	Not reliable or timely, misses meetings, misses deadlines	Performs some duties reliably, mostly timely, misses some meetings, meets some deadlines	Performs duties reliably and timely, attends meetings, meets deadlines	Performs all duties reliably and timely, attends all meetings, meets all deadlines, provides leadership	
Leadership, acceptance, collaboration, assistance	Rarely takes leader role, generally accepts assignments, has difficulty collaborating, sometimes willing to assist teammates	Occasionally leads, usually accepts assignments, mostly collaborates, generally willing to assist teammates	Shows an ability to lead when necessary, to accept assignments, to collaborate, and is willing to assist teammates	Takes leadership role, accepts all assignments, is a good collaborator, and always willing to assist teammates	
CONCEPT 3: Values other viewpoints					
Listens, values other perspectives, compromises	Not a very good listener, may not always see or understand others points of view, not willing to compromise	Fairly good listening skills, can usually appreciate other perspectives, may not be willing to compromise	Good listening skills, values teammate perspectives and experiences, often willing to compromise to complete tasks	Listens to teammates and values their perspectives, knowledge, and experiences. Always willing to compromise to complete tasks	

Table I.5 Scorecard for program outcome *e*

Ability to identify, formulate, and solve engineering problems					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria					
CONCEPT 1: Problem identification and formulation					
Problem identification and formulation	Cannot identify or formulate problem correctly	Major errors in problem formulation that lead to unsafe solution	Minor errors in problem formulation that do not result in unsafe solution	Correctly formulates and identifies problem	
CONCEPT 2: Solve engineering problems					
Analyze and solve engineering problems	Incorrect problem analysis leading to incorrect solution	Major errors in analysis and/or solution of problems leading to unsafe design	Minor errors in analysis and/or solution of problems resulting in uneconomical but safe design	Correct analysis and solution arriving at safe, economical design	
Comply with relevant code requirements	No consideration of relevant code requirements	Code requirements considered but incorrectly applied. Some criteria neglected	Code requirements checked but minor errors made	Relevant code requirements are met by final design	

Table I.6 Scorecard for program outcome *f*

An understanding of professional and ethical responsibility					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria					
CONCEPT 1: Can use code of ethics					
Use of ASCE code to guide decisions	Does not correctly reference sections of the ASCE Code of Ethics in an ethics case study	Cites applicable sections of the ASCE Code, but may not correctly use in decision process	Correctly cites applicable sections of the ASCE Code and explains how they guide the decision/choice	Correctly cites several applicable sections of the ASCE Code for each specific dilemma/decision and explains the meaning/implications	
CONCEPT 2: Understands complexity of ethics					
Recognizing ethical issues	Realizes something is not “right” but not able to correctly identify professional/ethical issues at play. Sees mostly “black & white”	Can identify what is legal/illegal, acceptable by the ASCE Code, acceptable to an employer, but not clear on ethics in “gray” areas	Is able to clearly identify/name the inherent ethical choices and implications involved in various engineering decisions	Clearly identifies the inherent ethical choices and implications involved in various engineering decisions. Understands the effects of perspective, context, and personal views, codes, and laws	
Responsible deliberation	May be capable of discussing ethical issues, but unclear on own position or effects of different perspectives	Comfortable discussing ethical issues from own point of view. May have difficulty seeing different points of view	Can discuss ethical issues with sensitivity to others point of view. Can debate issues from different perspectives	Is capable of discussing and debating ethical issues with sensitivity to others’ perspectives while also defending own position with logic and fact	
CONCEPT 3: Making ethical decisions					
Using ethical	Shows little evidence of	Is able to recognize	Uses a logical,	Uses a logical, systematic	

<p>decision making framework</p>	<p>use of a systematic decision making framework</p>	<p>ethical issues, determine alternatives, and make a decision without reflecting deeply or considering multiple perspectives</p>	<p>systematic decision process. Recognizes issues, states facts, evaluates alternatives from different perspectives, is able to make a decision</p>	<p>decision process. Identifies each step, provides reflective data, evaluates alternatives from different perspectives, is able to defend decision</p>	
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Table I.7 Scorecard for program outcome g

An ability to communicate effectively					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria					
CONCEPT 1: Contributes to group discussions/presentations					
Can express opinions effectively	Has no opinions or does not share them intelligibly	Attempts to express opinions, but they are not relevant	Expresses opinions such that others are interested and respond	Convincingly expresses opinions	
Can make effective technical presentations	Presentation is unorganized, not well-planned, or does not use modern tools	Presentation is reasonably well organized, but the oral presentation is poor	Presentation is well-organized and planned, and oral presentation is acceptable	Presentation is well-organized and planned, and oral presentation is good	
CONCEPT 2: Values other viewpoints					
Listens to and respects other viewpoints	Does not listen to others or dismisses their views	Listens to others, but has difficulty recognizing value of alternative views	Listens to others and values their views	Encourages others to express their views so as to enrich the discussion	
CONCEPT 3: Speaks effectively					
Speaks clearly and engages the audience	Speaks unintelligibly and/or avoids any eye contact	Speaks relatively clearly with some eye contact, but does not engage the audience	Speaks well, good eye contact and attempts to engage the audience	Speaks well, good eye contact, and involves the audience	
Presents/defends his/her position well	Cannot or will not 'argue their case'	Attempts to defend their case, but is not successful	Acceptable defense of their case	Successfully argues their case	

CONCEPT 4: Writes Effectively				
Grammar and punctuation	Subjects and verbs do not agree, incorrect use of pronouns, sentence fragments and run-ons, significant ESL problems, incorrect use of punctuation	Some subjects/verbs do not agree, mixed use of pronouns, some run-on sentences and/or sentence fragments, and/or significant ESL problems	All subjects/verbs agree, mostly correct use of pronouns, mostly no run-on or sentence fragments, all punctuation is correct, no ESL problems	All subjects/verbs agree, correct use of pronouns, no run-on or sentence fragments, all punctuation is correct, no ESL problems
Clarity and composition	Many wordy sentences, all passive verbs, dangling modifiers, repetitive words/sentences, many misspellings	Some wordy sentences, too many passive verbs, some sentence/word variety, incorrect level of formality, misspellings	Mostly direct sentences, uses active verbs, uses balanced ideas, uses a variety of sentences/words, no dangling modifiers, correct degree of formality, almost no misspellings	Direct and concise sentences, uses active verbs, no dangling modifiers, uses balanced parallel ideas, uses appropriate voice, no misspellings
Content and style	Does not fully respond to the assignment, disorganized, few facts or evidence, lack of detail, non-analytical, incomplete thoughts/descriptions, only uses basic ideas, includes clichés	Fairly responsive, some evidence of organization of ideas, some correct facts and evidence, somewhat thoughtful or reflective, incorrect use of terminology/jargon/clichés	Responsive to assignment, mostly organized ideas/arguments, good use of facts and evidence and details, fairly thorough/analytical, at least somewhat thoughtful/reflective, correct use of terminology/jargon, no clichés	Fully responsive to question, uses organized arguments, correct use of facts/evidence, provides details, thoughtful/reflective, thorough, analytical, nuanced, correct use of terminology/jargon, no clichés

Table I.8 Scorecard for program outcome *h*

The broad education necessary to understand the impact of engineering solutions in a global, economic, societal and environmental context					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria	CONCEPT 1: Role of civil engineering				
Understands role of civil engineering in society	Does not appreciate the role civil engineers play in society	Has some understanding of the societal role	Acceptable understanding of the role	Understands the role; sees how it can be improved or how it is sometimes not met	
	CONCEPT 2: Understands impact of civil engineering systems in a global, economic, environmental and societal context				
Understands impact of civil engineering systems in a global, economic, environmental and societal context	Does not understand basic impact of civil engineering systems in a global, economic, environmental and societal context	Understands a few impacts	Understands some impacts	Understands most impacts of civil engineering systems in a global, economic, environmental and societal context, and how they affect civil engineering practice	

Table I.9 Scorecard for program outcome *i*

A recognition of the need for, and an ability to engage in, life-long learning					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria					
CONCEPT 1: Changing technology					
Recognizes that changing technology will require constant learning	Unaware that future self study and technical seminars are required	Aware that knowledge acquisition is continuous but expect to be told to do this	Aware that knowledge acquisition is continuous and plans to do this on his/her own	Involves him/herself in learning activities outside the classroom	
Can review and summarize technical material that was not presented in the course	Unable to learn without direct instruction	Has difficulty learning on his/her own	Able to assimilate outside material	Able to synthesize outside material	
CONCEPT 2: Business environment					
Understands that business opportunities will require working in unfamiliar areas	Uncomfortable with new tasks, ideas and large or unfamiliar projects	Can deal with new tasks, ideas and large or unfamiliar projects, but needs support	Handles new tasks, ideas and large or unfamiliar projects	Competent when new tasks, ideas and large or unfamiliar projects are presented to him/her	
Can largely self-learn and apply a new technical or business tool	Uncomfortable with new platforms and tools	Can deal with new platforms and tools, but needs support	Handles new platforms and tools	Competent in use of new platforms and tools	

Table I.10 Scorecard for program outcome *j*

Knowledge of contemporary issues					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria					
CONCEPT 1: Current events					
Aware of local current events*	Unaware of major local development on politics, law, economy or infrastructure	Aware only of some of the local “headlines”	Partly aware of the issues associated with major local current events	Aware of the issues and ramifications of major local current events	
Aware of national and international (N+I) current events**	Unaware of major N+I development on politics, law, economy or infrastructure	Aware only of the N+I “headlines”	Partly aware of the issues associated with major N+I current events	Aware of the issues and ramifications of major N+I current events	
CONCEPT 2: Impact and consequences of current events					
Conceives how current events can affect CE	Unaware of any linkages between current events and CE	Has some thoughts about a connection between current events and CE	Somewhat aware that many current events can affect CE	Aware of how current events affect CE practice and development	
Conceives how CE can affect current events	Unaware of ways in which CE affects current events	Has some thoughts about a connection between CE and current events	Somewhat aware that CE affects several current events	Aware of how CE practice and development affects some current events	

* Example: Major highway project, major taxation for infrastructure, major local election results, local infrastructure calamity, etc.

** Example: Major infrastructure initiative, act of Congress, energy prices, major technological breakthrough, national election results.

Table I.11 Scorecard for program outcome *k*

An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice, particularly recognizing the integral role of computers in engineering and the rapid expansion of resources on the Internet					
	<u>Unsatisfactory</u> 1	<u>Developing</u> 2	<u>Acceptable</u> 3	<u>Good</u> 4	<u>Score</u>
Performance Criteria					
CONCEPT 1: Internet resources/downloads					
Obtains engineering tools from the Internet with minimal assistance	Does not download any software that relates to the assignment	Downloads software that relates to the assignment with some assistance	Downloads software that relates to the assignment with little assistance	Downloads software that relates to the assignment with no assistance. Discovers other software available.	
CONCEPT 2: Usage of tools					
Uses tools to solve engineering problems effectively	Knowledge on the relationship between software and classroom material is poor and riddled with mistakes	Uses tools/software to solve problems with little understanding of the relationship between software and classroom material and makes some mistakes	Uses tools/software to solve problems with some understanding of the relationship between software and classroom material and makes few mistakes	Uses tools/software to solve problems with understanding of the relationship between software and classroom material and makes minor mistakes. Checks solution with other means.	
Hand checks computer solutions	Does not hand check computer solution	Hand checks computer solution with some mistakes	Hand checks computer solution with few mistakes	Hand checks computer solution with minor mistakes	