College of Engineering and Engineering Technology

Department of Industrial and Systems Engineering

Industrial and Systems Engineering

Bachelor of Science

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Submitted to the University Assessment Panel by:

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1. Introduction

The Bachelor of Science program in Industrial and Systems Engineering (ISYE) at Northern Illinois University was initially accredited in 1990 by the Accreditation Board of Engineering and Technology (ABET). The most recent accreditation visit was in 2016. The B.S. in ISYE program is fully accredited by ABET till 2023. The next accreditation visit will be in 2022. The programs student learning outcomes are modelled based off ABET guidelines. ABET changed their guidelines from 11 student learning outcomes (commonly referred to as outcomes A through K) to 7 outcomes (referred to as outcomes 1 to 7) recently. Consequently, starting from fall 2018 the ISYE program revised their program outcomes and tailored their assessment plans to assess the new ABET guidelines.

2. Student Learning Outcomes (SLOs)

The Department of Industrial and Systems Engineering has developed its learning objectives (or program outcomes) to be consistent with the Accreditation Board of Engineering and Technology (ABET) criteria. The department conducted several faculty meetings in AY 2017-2018 to understand the new ABET outcome guidelines. These meetings led to drafting our SLOs and developing an assessment plan. Starting in AY 2018-19, the learning objectives are

1. An ability to identify, formulate, and solve complex Industrial and Systems engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audience.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Each outcome is more acutely defined with a set of operational definitions. These definitions provide a more detailed description of the objectives of each outcome. The operational definitions of each program outcome is shown in Table 1. The curriculum and assessment committee worked with all full-time faculty in the department to develop the operational definitions for each SLO.

Table 1. Program Outcome and Operational Definitions

Program Outcomes		Operational Definitions	
1	An ability to identify, formulate, and solve complex Industrial and Systems engineering problems by applying principles of engineering, science, and mathematics	1.1	Formulates the given system appropriately for the purpose of understanding the qualitative and/or quantitative behavior of the system and the effects of potential changes made to the system.
		1.2	Identifies constraints or customer requirements and key areas in a given system where improvements can be made.
		1.3	Applies appropriate engineering principles to solve complex Industrial and Systems engineering problems.
		1.4	Applies appropriate science principles to solve complex Industrial and Systems engineering problems.
		1.5	Applies appropriate mathematical tools to solve complex Industrial and Systems engineering problems.
		1.6	Chooses the "best" solution based on stated criteria and formulates evidence that supports the solution.
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	2.1	Identifies and understands the critical issues and determines the overall goal and objectives of the design project.
		2.2	Determines what information is critical and evaluates resources needed to obtain it.
		2.3	Applies analytics tools, software, creativity, and "outside-of-the-box thinking" to generate solutions.
		2.4	Evaluates and selects the preferred solution(s) considering technical, non-technical or external factors and design tradeoffs.
3	An ability to communicate effectively with a range of audience.	3.1	Communicates information, concepts, and ideas effectively in writing using standard formats, grammar, and mechanics.
		3.2	Communicates information, concepts, and ideas effectively through well-organized and high quality presentations.
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	4.1	Demonstrates knowledge of codes of conduct that guide the professional practice of engineering.
		4.2	Identifies various types of impacts for an engineering solution (i.e. environmental, political, economical, etc.).
		4.3	Questions decision by incorporating the ethical impacts the decision can have on the individual, the client, the company and/or the public.
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.	5.1	Shares responsibilities and duties, and takes on different roles when applicable.
		5.2	Develop solutions through consensus by analyzing alternative perspectives and ideas objectively.
		5.3	Develop and follow a project plan with milestones to achieve project goals.
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions	6.1	Defines a problem statement, dependent/independent variables and/or appropriate hypothesis.
		6.2	Uses and documents measurement techniques to collect data.
		6.3	Applies appropriate tools and techniques to analyze data.
		6.4	Interprets results and draws conclusions with respect to the assumptions and constraints.
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	7.1	Demonstrates an understanding of emerging trends and innovation in Industrial and Systems engineering.
		7.2	Demonstrates the ability to use information-seeking tools.

3. Program-by-Baccalaureate Student Learning Outcomes Matrix

This section of the assessment plan shows the alignment of the Industrial and Systems Engineering undergraduate degree program student learning outcomes with NIU's baccalaureate student learning outcomes. Each outcome is indicated by strongly supports (S), moderately supports (M), or doesn't support (leave blank) for each baccalaureate learning outcome

Program Student Learning Outcome	Baccalaureate Student Learning Outcomes							
	A. Global inter-connections and inter-dependencies	B. Intercultural competencies	C. Analyze human life and natural world inter-connections	D. Critical, creative, and independent thought	E. Communicate clearly and effectively	F. Collaborate with others	G. Quantitative and qualitative reasoning	H. Apply knowledge/ skills creatively
1. Applying principles of engineering, science, and mathematics							S	S
2. Public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	S	M	M	M			S	S
3. Communicate effectively		M			S			
4. Recognize engineering ethical and professional responsibilities and the impact in global, economic, environmental, and societal context	S	M	M				M	
5. Team collaboration		S				S		
6. Experimentation, data analysis and use engineering judgement to draw conclusions				S			S	S
7. Acquire and apply new knowledge				S			M	M
Overall	S	S	M	S	S	S	S	S

4. Curriculum Map

Each faculty member who teaches a required course was asked to help develop the curriculum map. It accumulates input from all faculty in the department. Where the required courses are taught by more than one faculty, the faculty group was asked to discuss and help develop the curriculum map. The curriculum map indicates the relationship between the required courses and the SLOs. The curriculum map includes all required courses in the program. ISYE 493/494/495/496 are the senior design project courses. Each section corresponds to a different focus (i.e. manufacturing, health systems, general industrial and systems engineering, and engineering management) which corresponds to the emphasis or non-emphasis options for their chosen degree path. The assessment tools and methods are the same for all of the sections. The required courses for all the emphasis and general industrial and systems engineering are the same. They all differ only in the technical electives.

	Program Student Learning Outcomes						
Course	1. Principles of engineering, science, and mathematics	2. Public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	3. Communicate effectively	4. Ethical and professional responsibilities in global, economic, environmental, and societal contexts	5. Collaborate effectively on a team	6. Experimentation, data analysis and use engineering judgement to draw conclusions	7. Acquire and apply new knowledge
ISYE 220	B						
ISYE 250	B	B	B		B		
ISYE 310	B	D	P		P	P	
ISYE 335	P		D		P	P	
ISYE 350	P	B	B	D	D		P
ISYE 370	P					P	
ISYE 371	P					P	
ISYE 410	D		P		P	P	
ISYE 430	P		P		P	D	
ISYE 435	P	P	D		P	P	
ISYE 440	P		P		P		D
ISYE 450	P	P	P		P		
ISYE 460	P	P	P		P		

Course	Program Student Learning Outcomes						
	1. Principles of engineering, science, and mathematics	2. Public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	3. Communicate effectively	4. Ethical and professional responsibilities in global, economic, environmental, and societal contexts	5. Collaborate effectively on a team	6. Experimentation, data analysis and use engineering judgement to draw conclusions	7. Acquire and apply new knowledge
ISYE 480	P	P	P	D	P	P	
ISYE 492				D			D
ISYE 493/494/ 495/496	P	P	P	P	P	P	P
Note. Course supports the outcome at the B=beginning, D=developing, or P=proficient level.							

5. Assessment Methods

The department has four assessment methods that used to collect data on student performance. Course-embedded assessments are collected by each course instructor and for each required course, as shown in the Curriculum Map table. Each course instructor determines the activity that best measures the outcome identified in the curriculum map.

Assessment Method	**Explanation**					
	Description	Student-Level Achievement [a]	Program-Level Target [b]	When Data Will be Collected	Person Responsible	SLOs Covered
Course-embedded assessments	Evaluation of student's performance on specific activities (e.g. assignments, quizzes, papers, projects, and exams).	A student will achieve a score of 3 or better (out of 4) on the activities in the course.	50% of all students will meet the student-level target.	Fall and Spring	Course Instructor	Please see Curriculum Map table.
Senior Design project appraisals	Evaluation of senior design projects by the instructor, faculty members, and industry sponsors using a rubric with five performance criteria.	A student will achieve a score of 3 or better (out of 4) on each of the five performance criteria on the rubric.	80% of all students will meet the student-level target (i.e., achieve a score of 3 or better on each of the five performance criteria on the rubric).	During the final oral presentation at the end of Fall and Spring semesters	Course Instructor	1, 3
Exit Survey	Graduating student's feedback on how well they achieved the student learning outcomes.	A student will achieve a score of 3 or better (out of 4).	50% of all students will meet the student-level target.	Fall and Spring	Department Chair	1,2,3,4,5,6,7
Employer Survey	Evaluation of senior design project, internship, or co-op by employers on how well the student achieved the student learning outcomes.	A student will achieve a score of 3 or better (out of 4).	50% of all students will meet the student-level target.	Fall, Spring, and Summer	Course Instructor	1,2,3,4,5,6,7

Note. [a] Student-level target is the score or performance an individual student must demonstrate to say the student met the student learning outcome.
[b] Program-level target is the percent of all students that must demonstrate they meet the student learning outcome.

ASSESSMENT METHODS-BY-OUTCOMES MATRIX

Assessment Method	**Program Student Learning Outcome**						
	1. Principles of engineering, science, and mathematics	2. Public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	3. Communicate effectively	4. Ethical and professional responsibilities in global, economic, environmental, and societal contexts	5. Collaborate effectively on a team	6. Experimentation, data analysis and use engineering judgement to draw conclusions	7. Acquire and apply new knowledge
Course embedded assessments	F, D	F, D	F, D	F, D	F, D	F, D	F, D
Senior Design project appraisals	S, D		S, D				
Exit Survey	S, I	S, I	S, I	S, I	S, I	S, I	S, I
Employer Survey	S, I	S, I	S, I	S, I	S, I	S, I	S, I
Note. F=formative assessment, S=summative assessment, D=direct assessment, and I=indirect assessment. See the paragraph above for an explanation of each type of assessment.							