EVALUATING PROGRAM COMPLIANCE WITH ABET STANDARDS WITHIN UIR'S COLLEGE OF ENGINEERING

Report for UIR's Aerospace Engineering, Automotive Engineering, Computer Science, and Energy Engineering Programs

Presented To:
Professor Mohammed Boulmalf
Université Internationale de Rabat

Professor Joseph Doiron
Professor Mohammed El Hamzaoui
Worcester Polytechnic Institute

Presented By:
Katie Houskeeper '23
BS Data Science | MS Management

Morgan E. Hughes '23
BS Civil Engineering | MS Fire Protection Engineering

Mary Suckow '23
BS Management Engineering

Evaluating Program Compliance with ABET Standards within UIR's College of Engineering

An Interactive Qualifying Project
submitted to the faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillments of the requirements for the
degree of Bachelor of Science.

Written by:
Katie Houskeeper
Morgan E. Hughes
Mary (Addie) Suckow

gr-UIR-ABET-D22@wpi.edu

Date:
05 May 2022

Report Submitted to:

Professor Mohammed Boulmalf
Université Internationale de Rabat

Professor Joseph Doiron
Professor Mohammed El Hamzaoui
Worcester Polytechnic Institute

Abstract

The goal of our project was to complete an initial ABET accreditation audit of the Computer Science, Aerospace Engineering, Automotive Engineering, and Energy Engineering programs at the International University of Rabat. To measure each program's current progress toward accreditation, we performed direct and indirect evaluations and compiled findings and recommendations for each program. Direct evaluations included the analysis of one hundred and three syllabi. For indirect evaluations, twenty-one interviews and fourteen surveys helped identify themes among stakeholder groups. This report outlines the methodology used and the findings and recommendations made. As supplementary material, various tools provided to the university will allow them to replicate our methodology in the future.

Figure 1: International University of Rabat

Acknowledgements

Throughout completing this Interactive Qualifying Project, countless individuals have aided us in our endeavor. Our team would not have been able to succeed without the help of all of the following:

First, we would like to thank our project advisors, Professor Mohammed El Hamzaoui and Professor Joseph Doiron of WPI. This project would not have been nearly as successful as it was without your direction and guidance at each stage of the process. Thank you for the countless hours listening to our ideas, editing our work, providing constructive criticism, and the patience you have shown toward us throughout learning how to navigate this project.

Next, we would like to thank our sponsor, Professor Mohammed Boulmalf, the Director of the School of Information and Digital Sciences, at the International University of Rabat, for creating this opportunity for project work. Thank you for the spectacular effort you exerted towards encouraging UIR faculty and staff to support us as well as collecting the materials needed. Your eagerness to hear the program's successes, paired with your willingness to listen and better areas that need improvement, undoubtedly prove your kind character and commitment to bettering this university.

A huge thank you to Assistant Professor Anass Sebbar of the Computer Science program at UIR; it goes without saying that UIR is a better place because of you. Your enthusiasm toward supporting our team and working to provide innovative education for your students doesn't go unnoticed. But, most importantly, thank you for being Mohammed's best friend and bringing the joy back into our work as we foolishly began to doubt ourselves in this process.

Professor Radouane Ouladsine, we greatly admire your dedication to UIR, students, and the ABET accreditation efforts you are working so diligently to further. Soon, you will see all of your work culminate into everything you hoped it would be at the start of this endeavor.

Additionally, we would like to thank the following members of the UIR community for their consistent support in the last eight weeks: Professor El Hashmi Essadiqi, Professor Mohamed Omar Ashraf, Professor Khalid Bouziane, Yasmine Bakri, Sanae Labghough, Sarah Lahlou, and Oumaima Fadi. Similarly, thank you to these individuals from WPI: Professor Rebecca Moody for your dedication to the Morocco Project Center and each person on this team, Lori Ostapowicz-Critz for strengthening our skills in research methods, and Professor Craig Wills for your expertise on computing accreditation.

Lastly, our team would like to thank every individual who took the time to respond to our surveys and interview with our team. Although your names are not shared publicly, your influence and experiences

culminated in the findings and recommendations presented in this report and will hopefully serve the entire UIR community by fostering positive improvements and continued excellence in the College of Engineering.

Our team holds immeasurable gratitude for the people, places, and experiences we have encountered in the last two months. We are so lucky to have been in Rabat during the holy month of Ramadan and to immerse ourselves in the opportunities presented to us. While we will miss the endless mint tea, couscous Fridays, and so much more, these experiences will never be forgotten and will be kept close to our hearts as we continue into adulthood and careers.

Executive Summary

Project Motivations

ABET, the Accreditation Board for Engineering and Technology, founded in 1932, is a prestigious, non-governmental organization that analyzes university programs in terms of their compliance with success standards needed in a Science, Technology, Engineering, and Math (STEM) education. Obtaining this accreditation assures a university that a program meets the quality standards necessary to appropriately prepare students for their desired field while also bettering student outcomes post-graduation. Our sponsor, Professor Mohammed Boulmalf, the Director of the Computer Science program, along with several other members of the International University of Rabat (UIR) community, have been working to seek ABET Accreditation for four programs over the past several years. Along with the other benefits of obtaining accreditation, the UIR specifically hopes that accreditation will make them a more competitive member on the global higher education stage. The University's vision of becoming a world-class African University can be furthered as those with accredited programs often provide their students with access to multinational companies and receive a more significant number of global partnerships, scholarships, and grants.

Our team worked to aid in this endeavor by making progress towards Step Three of the ABET Accreditation Process, the Self Study Report. The Self Study Report, composed of both quantitative and qualitative data that outlines the strengths and limitations of the program, is the foundational document used by the ABET Accreditation Team when evaluating a program. The project goal was to complete an initial ABET accreditation audit for UIR's Computer Science, Aerospace Engineering, Automotive Engineering, and Energy Engineering programs while providing recommendations on implementing sustainable processes. To accomplish this we created the following two objectives focusing on completing direct and indirect evaluations of each program.

Objective 1: Syllabi Evaluations

The project's first objective included a direct evaluation of each program by analyzing course syllabi. We completed an analysis of the entire syllabus, looking for any incorrect formatting, incomplete sections, or instances where the document had contradictory information. The Outcome Mapping Section of the syllabus required the most in-depth review, as two types of outcomes had to be understood and aligned. Student Outcomes (SOs) are provided by ABET while instructors create Course Outcomes (COs). In order to standardize the process, our team created a course mapping tool. The tool heavily utilizes the IRE

system where “I” indicates when a course introduces the student outcome, “R” indicates when a course reinforces the student outcome, and “E” shows when a course emphasizes the student outcome.

Together, the mapping tool, inter-rater reliability scores, and the evaluation of syllabi contents were combined to compile findings about each program’s strengths and weaknesses. Our team identified areas of improvement and potential solutions for each program to not only enhance the student experience, but also more closely relate to the standards that accreditation requires.

Objective 2: Surveys and Interviews

Our second objective was to perform an indirect evaluation of each program’s current operations through an analysis and understanding of each stakeholder’s perspectives and experiences. The four stakeholders that our team evaluated were students, faculty, alumni, and employers. Unlike the direct evaluation of objective one, this objective focused on qualitative metrics such as stakeholder opinions and suggestions.

The team obtained these findings through a combination of surveys and interviews. Fourteen surveys, eight in English and six in French, were developed and distributed to the stakeholders. For further evaluation, students, faculty, and alumni were asked to complete an interview with our team in hopes of offering a more open space to discuss specific examples and/or details we may not get from a traditional survey. This led to a more comprehensive understanding of these experiences and, paired with survey data, allowed a holistic overview of findings and recommendations for each program.

Once we completed both direct and indirect evaluations, the team utilized all information to compile program-specific reports. These reports included all survey data, information we gathered through interviews, and the general findings and recommendations about course syllabus creation. We also included deliverables, the necessary templates and tools created by our team, to allow for further evaluation and continuous improvement of these programs in the future. Together, this report and the deliverables display our team’s work throughout this semester and conclude our team’s contributions to the ABET Self-Study Report.

Summary of Findings & Recommendations

Although a holistic understanding of our methods, findings, and recommendations can only be understood through the full review of this report along with our appendices and deliverables, the following section outlines significant findings consistent within all programs. For more detailed information on specific programs, please refer to Deliverable 5.

Objective 1: Syllabi Evaluations

Lack of Syllabi Consistency

Finding: While programs have a standardized syllabus, our team found that instructors lack a cohesive understanding of what content belongs in each outlined subsection.

Recommendation: Our team recommends providing workshops detailing how to correctly create a syllabus and offering examples of model syllabi for faculty members to reference. These recommendations are made in hopes of standardizing not only the format but the content, which will aid faculty, administrators, students, and accreditation evaluation teams alike.

Incorrectly Mapping Course Outcomes to Student Outcomes

Finding: Often, instructors have defined course outcomes that do not provide an encompassing perspective of course components. This can lead to a discrepancy in the correlation of course outcomes to student outcomes and incorrectly portrays the course's ability to prepare students for specific technical or interpersonal skills needed upon graduation. This finding was primarily identified within the following areas: communication, professional/ethical judgments and considerations, teamwork, and lab components.

Recommendation: Streamline the creation of course outcomes to formulate four to five course outcomes that encapsulate all components of a course and their relationship to the program's student outcomes. If implemented, this recommendation will allow for an ABET accreditation team to better understand each course's contents and recognize the efforts of the instructor to prepare their students within their chosen industry.

Usage of Verbs Correlating to the IRE System

Finding: The most consistent finding amongst the four evaluated programs was the lack or incorrect usage of IRE verbs in course outcomes to correctly display where a student outcome is being introduced, reinforced, or emphasized.

Recommendation: On the standardized syllabus, the definitions of IRE need to be changed as currently they are as follows:

E= Emphasize (Strong), **R**= Reinforce (Intermediate), **I**= Introduce (Weak)

The use of weak, intermediate, and strong misrepresents the IRE System and often leads to incorrect mapping of all course outcomes. Our team recommends that instructors be provided with the list of verbs and their correlation to IRE (Deliverable 2) as well as a workshop that teaches instructors about each level and its correlation to Bloom's Taxonomy as defined in this IQP report. With an understanding of this, faculty members will be able to easily and correctly create course outcomes. Considering the IRE System

is the primary method of communicating how each program is achieving the ABET student outcomes, all faculty members must have a consistent understanding of the system and its implementation.

Objective 2: Surveys and Interviews

Faculty's Lack of Understanding Surrounding ABET

Finding: Through interviewing faculty members, a lack of understanding of the ABET accreditation benefits became clear to our team. This contributes greatly to the reluctance of faculty members to adjust their courses to align more with accreditation standards.

Recommendation: We recommend using seminars, infographics, or faculty meetings to explain ABET and its benefits to faculty members. An emphasis should be placed on hearing their concerns and answering their questions about accreditation and its processes before expecting them to support all the changes. We offer this suggestion in hopes of increasing the faculty's understanding of ABET and, in turn, their willingness to adapt their course structure and methods of assessment.

Increased Need for Hands-On Learning & Technology Upkeep

Finding: While students in their preparatory years at the university receive a reasonable amount of lab work and exposure to project teams in courses such as Chemistry and Physics, interviews indicated that this is not a universal experience throughout the latter years of education. Additionally, in the opportunities where fourth and fifth years have the chance to gain experience in the lab, it was noted by alumni and students alike the material being taught does not align fully with industry standards. UIR appears to have an adequate amount of machinery and resources, however, it is not put to appropriate use as faculty students and alumni often noted this equipment was malfunctioning or unavailable.

Recommendation: Our team recommends UIR's College of Engineering increase the amount and quality of hands-on learning for students in their final years of university. In doing so, the gap between classroom learning and real-world application must be fully bridged, including providing opportunities to work with industry-standard equipment, solving authentic problems, and working within teams with diverse skill sets. In order to successfully implement this recommendation, the university must first ensure the upkeep of current technology, then strategically invest in more that will benefit students in the learning of technical skills needed post-graduation.

Access to Campus Resources

Finding: There are many areas where UIR students within the College of Engineering could use additional support. Students and alumni both expressed an absence of support and guidance in searching for post-graduate opportunities. While our team found that there is a career development office in place at the university, it is seldom used by students which is likely from a lack of knowledge about it.

Additionally, students and alumni both feel as though they have very limited access to interacting with industry professionals. This is an important interaction for students to learn more about their field and practice their professional communication skills. Lastly, faculty members are a great support to students within each program, however there is a lack of opportunities for peer-to-peer learning in settings like tutoring and mentoring.

Recommendation: Our team recommends that the career development office currently in place expands their available resources to include things like resume and cover letter workshops, interview practice sessions, etc. that will better prepare students to enter the workforce. To give students additional avenues of meeting industry professionals and learning more about their field, we recommend bringing people in to give seminars, question and answer sessions, etc. Additionally, we recommend implementing career fairs to showcase local companies that are interested in hiring UIR students. This would also demonstrate the post-graduate opportunities that are available to students.

Table of Authorship

Chapter	Section	Subsection	Primary Author(s)	Primary Editor(s)
Abstract			Katie, Morgan	Katie
Acknowledgements			Morgan, Katie	Katie
Executive Summary			Morgan, Katie	Mary
Introduction			Morgan	Katie
Background	History and Background of North Africa	Introduction	Morgan	Katie, Mary
		North African Education Systems before European Colonization	Morgan	Katie, Mary
		Colonial Influence on Education	Mary	Katie, Morgan
	Morocco	Introduction	Mary	Katie, Mary, Morgan
		Higher Education in Morocco	Katie	Mary, Morgan
		Power Dynamics in Morocco	Mary, Morgan	Katie
	International University of Rabat	Introduction	Katie	Morgan
		Programs within the College of Engineering	Katie	Morgan
		Prof. Mohammed Boulmalf	Katie	Morgan
		UIR's Recent Efforts toward ABET Accreditation	Katie	Morgan
		Background of Methods and Tools	All	All
	ABET	Introduction	Morgan	Katie, Mary
		ABET Process and Standards	Morgan	Katie, Mary
		Benefits of an ABET Accreditation	Morgan	Katie, Mary
		ABET in Arab Countries	Morgan	Katie, Mary
		Global Outcomes	Morgan, Katie	Mary
Methodology	Project Goal		Katie	Morgan
	Project Objectives		Morgan	Katie
	Objective 1	Introduction	Katie	Morgan
		Syllabi	Morgan, Katie	Morgan, Katie
		General Format Analysis & Examining Section Contents	Morgan, Katie	Morgan, Katie
		Relation of COs and SOs	Katie, Morgan	Morgan, Katie
		Creation of Outcome Mapping Tool	Katie, Mary	Morgan, Katie
	Objective 2	Intro	Morgan	Katie
		Surveys (Development, Distribution, Data Analysis)	Morgan	Katie

		Interviews (Candidate Selection, Interview Questions, Thematic Coding)	Morgan	Katie
	Project Limitations and Considerations	Language	Katie	Morgan
		Ramadan	Katie	Morgan
		Differences in Higher Education	Katie	Morgan
		Timeline of Project Completion	Morgan	Katie
		Availability to be on Site	Morgan	Katie
		Interviewing Randomly Selected Students	Morgan	Katie
Findings	Introduction		All	All
	ABET Standards and Practices	Faculty's Lack of Understanding Surrounding ABET	Morgan	All
		Alignment of Course Outcomes and Student Outcomes	Mary	All
		Discrepancies within COs	Mary	All
		Incorrect Mapping	Mary	All
		Student Outcome Distribution	Mary	All
		Adoption of IRE	Mary	Katie, Morgan
		Lack of Syllabi Consistency	Morgan	Katie
	Findings Related to Student Academic Experience	Introduction	Morgan	Katie, Mary
		Student Workload	Morgan	Katie, Mary
		Hands-On Learning Opportunities	Katie	Morgan
		Industry Exposure	Katie	Morgan
		Lack of Classroom Technology Maintenance & Upkeep	Katie	Morgan
	Findings Related to Academic Personnel	Support from Personnel	Katie, Morgan	Morgan
	Summary of Discussion and Findings		Morgan, Katie	Morgan, Katie
Conclusion	Overview of Recommendations		Mary	Morgan, Katie
	Project Deliverables		Mary	Morgan, Katie

Table of Contents

Abstract 3

Acknowledgements 4

Executive Summary 6

Project Motivations 6

Objective 1: Syllabi Evaluations 6

Objective 2: Surveys and Interviews 7

Summary of Findings & Recommendations 7

Lack of Syllabi Consistency 8

Incorrectly Mapping Course Outcomes to Student Outcomes 8

Usage of Verbs Correlating to the IRE System 8

Faculty's Lack of Understanding Surrounding ABET 9

Increased Need for Hands-On Learning & Technology Upkeep 9

Access to Campus Resources 9

Table of Authorship 11

Table of Contents 13

Abbreviations 17

List of Figures 18

List of Tables 18

Introduction 19

Background Chapter 20

1.0 History and Background of North Africa 20

2.0 Morocco 21

2.1.1 Government Control 24

2.2.1 Societal Power Dynamics 25

2.2.2 Power Dynamics within Moroccan Higher Education 26

3.0 International University of Rabat 27

Bloom's Taxonomy and the IRE System 30
Standardized Syllabi 31
Inter-Rater Reliability 32
Stratified Random Sampling 33
CHAPTER TWO: METHODOLOGY 34
1.0 Project Goal 34
2.0 Project Objectives 34
Syllabi 35
General Format Analysis & Examining Section Contents 35
Examining the Alignment Between Course Outcomes and Student Outcomes 35
Creation of Outcome Mapping Tool using the IRE System 36
Surveys 39
Survey Development 40
Survey Distribution 42
Survey Data Analysis 42
Interviews 43
Interview Candidate Selection 43
Selection of Interview Questions 44
Thematically Coding Stakeholder Interviews 44
3.0 Project Limitations and Considerations 45
Language 45
Ramadan 46
Differences in Higher Education 46
Survey Development, Approval, and Distribution 46
Availability to be on Site 47
Interviewing Randomly Selected Students 47
CHAPTER THREE: FINDINGS 48

1.0 Introduction 48
2.0 Findings Related to ABET Standards and Practices 48
2.2.1 Discrepancies within Course Outcomes 49
2.2.2 Incorrect Mapping of Outcome Alignment 51
2.2.3 Student Outcomes Distribution and Inconsistencies 51
2.2.4 Adoption of the IRE System within UIR's College of Engineering 56
3.0 Findings Related to Student Academic Experiences 63
4.0 Findings Related to Academic Personnel 67
5.0 Summary & Discussion of Findings 69
CONCLUSION 71
Overview of Recommendations 71
Project Deliverables 72
Appendix A. Program Student Outcomes 74
Appendix B. Interview Questions 75
Appendix B.1 Statement of Consent 75
Appendix B.2 Student Interview Questions 76
Opening Questions 76
Program Questions 76
Faculty 76
Labs 76
Program Preparedness 76
Communication 76
Teamwork 76
Closing Questions 76
Appendix B.3 Faculty Interview Questions 77
Opening Questions 77
Program Questions 77

Course Questions 77
ABET/ Accreditation Specific Questions 77
Appendix B.4 Alumni Interview Questions 78
Demographics 78
General Questions 78
Faculty 78
Industry Preparation 78
Curriculum 78
Closing Questions 78
Appendix B.5 Employer Interview Questions 79
Demographics 79
General Questions 79
Closing Questions 79
Appendix C. Project Deliverables 80
Deliverable 1: Outcome Mapping Matrix Tool 80
Deliverable 2: IRE Verb List 81
Deliverable 3: Inter-Rater Reliability Calculating Tool 84
Deliverable 4: Thematic Coding Templates 85
Deliverable 5: Program Specific Reports 97
Deliverable 6: Formal Syllabi Notes 98

Abbreviations

Abbreviation	Word/ Phrase
ABET	Accreditation Board of Engineering and Technology
ASCE	American Society of Civil Engineers
Big Data & AI	Big Data & Artificial Intelligence
CAC	Computing Accreditation Commission
CO	Course Outcome
CS	Computer Science
EAC	Engineering Accreditation Commission
EC2000	Engineering Criteria 2000
EU	European Union
IQP	Interactive Qualifying Project
IRE	Introduce, Reinforce, Emphasize
IRR	Inter-Rater Reliability
ISI	Ingénierie des systèmes d'information
N/A	Not Applicable
NCSEE	National Council of State Boards of Engineering Examiners
PAB	Planning Accreditation Board
PEO	Program Educational Outcome
SO	Student Outcome
SSI	Sécurité des systèmes d'information
UAE	United Arab Emirates
UIR	International University of Rabat
UN	United Nations
WPI	Worcester Polytechnic Institute

List of Figures

Figure 1: International University of Rabat

Figure 2: Morocco's Geographic Location

Figure 3: The 17 Goals Outlined within the 2030 Agenda for Sustainable Development

Figure 4: Ten Largest Curricular Areas Accredited by Commission in 2016

Figure 5: ABET Student Outcomes for Computing Programs and Engineering Programs

Figure 6: Process of Mapping Individual Course Outcomes to Student Outcomes

Figure 7: Outcome Mapping Matrix Template

Figure 8: Example of Indicating Agreements/Disagreements in IRR Tool

Figure 9: Examples of Indirect Measurements of Success Broken Down by Stakeholder Category

Figure 10: Stratified Random Sample Example Calculation for Energy Engineering

Figure 11: Thematic Coding Interview Template Example

Figure 12: Examples of Thematically Coding Interview Responses

Figure 13: Combination of Course Outcomes Example

Figure 14: The Total Student Outcome Alignment within the Aero/Auto Program

Figure 15: Total Student Outcome Alignment within Year 2 of Aero/Auto Program

Figure 16: Total Student Outcome Alignment within Year 5 in the Aero/Auto Program

Figure 17: The Total Student Outcome Alignment within the Energy Engineering Program

Figure 18: The Total Student Outcome Alignment within the Computer Science Program

Figure 19: Increasing Student Outcome Alignment Example

Figure 20: Rewording Course Outcome with Proper IRE Verb Example

Figure 21: Yearly IRE Level Breakdown within the Aero/Auto Program

Figure 22: Preferred IRE Breakdown Example

Figure 23: Yearly IRE Level Breakdown within Energy Engineering Program

Figure 24: Student Ranking Results of Quality of Education

Figure 25: Alumni Responses, UIR Support with Career Opportunities

Figure 26: Alumni Responses, UIR Employer Interactions

Figure 27: Students Ranking of Academic Personnel

List of Tables

Table 1: Indicating the Relationship between the IRE System and Bloom's Taxonomy

Table 2: Standardized Syllabus Sections & Contents

Table 3: Surveys Developed and Distributed to UIR Stakeholders

Table 4: Survey Question Types with Examples

Introduction

Moroccan universities aim to propel their programs and students onto the global stage of education. One way to achieve this goal and ensure high quality is to have institutional programs gain industry-specific accreditation. Typically, those who obtain accreditation see increased prospective student interest and receive additional funding (ABET, n.d.). In addition, these programs are also held in favorable regard due to the rigor of their accreditation process and the demanding standards they must meet.

The International University of Rabat, as a newly established Moroccan university, is seeking ABET accreditation for four programs within the College of Engineering and Architecture: Aerospace Engineering, Automotive Engineering, Computer Science, and Energy Engineering. These program's accreditations would not only assure the quality of their programs but also allow for developing partnerships with other African universities and students around the continent, furthering their mission (UIR – Université Internationale de Rabat, n.d.).

The goal of this Interactive Qualifying Project was to complete an initial ABET accreditation audit for UIR's Computer Science, Aerospace, Automotive, and Energy Engineering programs while providing recommendations on implementing sustainable processes. Our team created the following two objectives to complete our project:

1. Evaluate syllabi for the Aerospace Engineering, Automotive Engineering, Computer Science, and Energy Engineering programs to assess their alignment with ABET Accreditation criteria.
2. Understand stakeholders' perspectives and experiences through conducting interviews and distributing surveys to identify themes and additional areas of improvement.

This report outlines background on the North African region, Morocco, ABET Accreditation, and the International University of Rabat. We also detail the methods and tools we used to complete our project goal and explain the findings compiled through data collection. Finally, our team makes general recommendations for the programs within the College of Engineering and include the use of the deliverables we handed over to our sponsor, Professor Mohammed Boulmalf, Head of the Computer Science Program at UIR. The directors of the Energy Engineering and Aerospace & Automotive Engineering programs received this report and program-specific reports.

Background Chapter

1.0 History and Background of North Africa

North African countries suffered from colonization and its lasting impacts when European countries began settling in the area. This section touches on North African education before and after colonization. This colonial influence embedded itself in every part of African ways of life and has left lasting markers, including government control on education systems which will also be discussed in this section.

1.1 North African Education Systems Before European Colonization

To fully understand North African education, specifically Moroccan education, in current times, it is important to note the impacts of colonization on the educational sector of this region. There are many misconceptions and stereotypes placed on African education including a widespread belief that Africans were uneducated until the colonization of the continent. Many authors, including Dama Mosweunyane, have written arguments against this claim. In the article *The African Educational Evolution*, Mosweunyane states that prior to colonial influence, "most learning that occurred in Africa was necessitated to meet the exigencies of the whole society" (Mosweunyane, 2013). Dr. Mosweunyane essentially presents the idea that African education was highly dependent on familial connections, word of mouth storytelling, and necessary techniques for survival. The system only lacked a theoretical base and documentation, making it seem less in comparison to more traditional, Western education. Again, while schooling was not traditional in the sense of their colonizers, Africans were providing skills and knowledge to one another that were unique to their environment.

Colonial influence impacted African countries far after the colonization and even into today. The powers of the colonizers seeped into African politics and caused the education system in the region to become more westernized. The colonial values brought into the area changed the traditional day-to-day experiences of an African and in turn changed the way Africans were educated.

1.2 Colonial Influence on Education

French influence throughout Northern Africa has been apparent since they colonized the many countries that make up the region. This influence is especially apparent when looking at the educational structure throughout the area. Many educational reforms were implemented from the late 1800s to the early 1900s to institute a more western structure throughout schools (Heggoy & Zingg, 1976). While most of these failed due to their hefty goals, an imprint was left within education systems in areas like the language

spoken and the teaching of technical skills. As the French government had the authority to appoint teachers, it was not surprising that those who spoke French were chosen to fill the positions. This left little room for Arabic to prevail as the primary language of instruction. After gaining their independence, some countries overhauled the strongest of French influences in schools and expanded their own cultural influence. At the same time, many kept a majority of the changes implemented by their French colonizers (Cogneau & Moradi, 2014). Morocco was one of the countries that tried to remove the French influence but was ultimately unsuccessful.

The Arabization project aimed to reintroduce Standard Arabic into society as the primary language of the country, specifically to have schools teach in it. But in the immediate aftermath of Moroccan independence, it wasn't easy to separate the French influence from the existing culture. The Ministry of National Education launched a charter in 2000 to reintroduce Standard Arabic into schools, with a push in 2008 to increase the effectiveness of the charter (Zakhir & O'Brien, 2017). They strongly encouraged teachers to use Standard Arabic in their classes and incorporate it into new course materials, particularly in science courses. This plan was impeded by the fact that French was used to teach science courses at universities, and teachers and students alike had come to see French as the language of education and showed very negative attitudes towards changing that (Zakhir & O'Brien, 2017). This standard of western education structure is still very prevalent today, with Arabic continuing to be the second most dominant language in education behind French.

2.0 Morocco

The cultural environment of Morocco is unique, specifically their feelings regarding higher education and the power dynamics found within their society and institutions. Morocco is in Northern Africa and has accepted migrants since as far back as the Roman Empire. The Arab conquest in the latter half of the seventh century led to North Africa to become known as the "Maghrib" and it is during this period that the majority of the region accepted Islam as their religion (*Morocco | History, Map, Flag, Capital, People, & Facts | Britannica*, n.d.). The first official dynasty of Morocco was recorded in the eleventh century, where the domain consisted of southern Spain through to regions of sub-Saharan Africa. In 1912, France imposed a French protectorate over Morocco which lasted until 1956 when they gained their independence and instituted their official government. To this day, it is the only country in North Africa with a monarchy.

Being on the coast, there are many major port cities including Casablanca and the capital city of Rabat. Even though Morocco is not a member of the European Union (EU), due to their proximity, the country is

considered an associate member of the EU and strives to keep strong ties with Western Culture and European countries (Hargraves, 2009). They maintain these connections by upholding the policies outlined in the Union for the Mediterranean and the European Neighborhood Policy. Furthermore, Morocco's largest trading partner is the European Union, proving that these ties remain strong.

The deep roots of Morocco have contributed to a strong culture and tradition throughout the country. The population consists mostly of Arabs and Amazigh, many of which are descendants of migrants who fled to Morocco for safety. Sub-Saharan Africans brought by slavery and trade and refugees from Spain have also become part of the Moroccan ethnic group (*Morocco | History, Map, Flag, Capital, People, & Facts | Britannica*, n.d.). Arabic is one of the national languages and is spoken by roughly two-thirds of the country, along with Tamazight, the official language spoken by the Amazigh. A majority of the population are Sunni Muslims and practice Islam, the state religion.

While roughly one-fifth of the country's budget is spent on education reforms, Morocco struggles to achieve a universal education due to its demographic history and lack of resources (Akkari, n.d.). There are many areas where access to education is limited, although these have been decreasing in the previous few decades due to the push for inclusive education. Some of the education issues stem from the high drop-out rate of students and gender divide among enrollment numbers. There is still a higher rate of illiteracy than the country wants, with about two-fifths of the population unable to read and write, which contributes to the poor education statistics (*Morocco | History, Map, Flag, Capital, People, & Facts | Britannica*, n.d.). Morocco has increased the push for an accessible quality education in recent years and is striving to rectify these issues and provide an inclusive education for all children in the country.

Figure 2: Morocco's Geographic Location (Sahara Tourism, n.d.)

2.1 Higher Education in Morocco

Attitudes towards higher education differ when looking at eastern and western ideologies. In this section we will discuss these differences specifically from the perspective of Moroccan students and educators. Morocco's educational framework has been subject to public scrutiny and debate since its independence in 1956 (Llorent-Bedmar, 2014). In the following year, the Royal Commission for Education Reform established basic principles for Moroccan education. These included hiring Arab faculty, tailoring curriculum to align with Arab values, and increasing access to education for all ages (Clark, 2006). The world's first and oldest educational institution, the University of Al-Qarawiyyin, was established in 1963 in Morocco after first being built as a mosque in 857 AD (Guinness World Records, n.d.). From there, Morocco began to emphasize the importance of higher education for its citizens. Today, Moroccan higher education is organized into public and private sectors. There is one public university with private management, 13 public universities, and 207 probate universities (MERIC-Net, 2019). Only 37% of Moroccans choose to enroll in higher education institutions (Zdanowski, 2014). The format of both public and private universities is two 16-week semesters. Within each semester, the student must learn a minimum of three modules, each lasting a minimum of 360 hours (MERIC-Net, 2019). Additionally, the frequent replacement of those appointed to serve as education minister, a position within the Moroccan government tasked with handling all educational matters, has greatly impeded Moroccan education system reforms.

In 2018, it was reported that over 25% of individuals in Morocco ages fifteen or above were deemed as illiterate (*Literacy Rate, Adult Total (% of People Ages 15 and above) - Morocco | Data*, n.d.). This high illiteracy rate is largely due to the low attrition rate in higher education institutions. In fact, 58% of Moroccan students drop out of university without a degree (Ludeman et al., 2020). Of that 58%, nearly 32% end up unemployed. This problem may, in part, be due to the lack of job opportunities and a tight labor market. It also indicates graduates do not obtain the skills required by employers to successfully join the working world while at University (Zdanowski, 2014). In addition, an overall focus for many Moroccan higher education institutions is enrollment growth as opposed to an increase in the quality of education programs. Thus, this expansion has led to a decline in the quality of education provided to students.

In an attempt to curb this education concern, Morocco continues to make a valiant effort towards a higher standard of education for all, such as adopting the 2030 Agenda for Sustainable Development in 2015, a "blueprint for achieving a better and more sustainable future for all" ((*The UN Sustainable Development Goals – UN Environment Management Group*, n.d.).

The 2030 Agenda for Sustainable Development was adopted in 2015 by all United Nations (UN) members, including Morocco, which is a plan to expand sustainability by accomplishing the seventeen goals laid out in the proposal. The fourth goal is to provide inclusive, equitable, quality education for all (United Nations, n.d.). Every few years, Morocco submits an update to the UN to show what progress they have made in the areas of the agenda, which they did most recently in 2020. This outlined that they were showing an improvement in student enrollment numbers, but they did not mention any other changes. Focusing solely on enrollment helps get more students access to schooling, but it also negatively affects the quality of education.

Figure 3: The seventeen goals outlined within the 2030 Agenda for Sustainable Development. (Transforming Our World: The 2030 Agenda for Sustainable Development, 2020)

2.1.1 Government Control

Since the country's independence, several reforms have been implemented in Morocco to improve their education system and add a more modernized approach, with many resources being allocated to these plans (Ayad et al., 2020). But unfortunately, none have been entirely successful, and few scholars and researchers who have looked at the issue can come to a consensus on why. Since the economic recession in the 1980s and 90s, Moroccan higher education has been damaged by many factors, including the mismanagement of universities, limited government funding, and the intervention in university affairs. Most of these are still prevalent today (Fahim et al., 2021). In the past decade, the Higher Council for Education, Training, and Scientific Research (CSEFRS) has determined that a large part of the issue is the government control over universities. There is very little communication between the leadership and managers of institutions, only short-term plans are made with no regard for long-term sustainability, and there is very little accountability at any level within universities (Ayad et al., 2020). Universities feel they have no autonomy and cannot make drastic changes to any aspect of their function without explicit consent from the government and ministry. This leads to many institutions not seeking change when necessary, and instead wait for the ministry to point out areas that require improvement, which they rarely

do. As a result, the quality of education in Morocco has been declining, with these issues being at the forefront.

With the Moroccan government so invested in the success of their education system, many steps need to be taken in order to have government intervention change and become helpful to institutions. Law requires all universities to submit to evaluation at different levels, including the ministry, university management, and professors, but these are assessed rarely (Ayad et al., 2020). This leads to university management operating with different goals and plans and not holding anyone accountable for actions that hurt the institutions. These evaluations should also be done on the actual course outcome level, which often doesn't happen. Going through an assessment of learning outcomes within schools would ensure that all meet the ministry's quality standards. While evaluating all of this would be incredibly time-consuming and lead to many flaws being unearthed within the management of universities, it would ultimately benefit schools greatly to ensure all aspects are matched up with the standards the university has set for itself and those the government of Morocco has set for it. Ultimately, the Moroccan government continues to be greatly invested in the education system, as they should, but need to shift their focus to using their influence and resources to make changes at every level in institutions, even regarding their intervention. Reforms keep being implemented with no actual plan to carry them out, leaving all levels frustrated with each other and no real change happening. The cultural environment of Morocco is unique and has a strong impact on how university proceedings are held, so while changes are being implemented, institutions need to look at the impact these factors have on their management as well.

2.2 Power Dynamics in Morocco

Power dynamics are a distinct characteristic of Moroccan culture, which we will look at on both a societal level and within institutions of higher education. The differences in social classes are a very prevalent factor in the function of society and within the education system. While this class structure has changed with the rest of the world, there are still strong correlations between the system and how society interacts and functions together.

2.2.1 Societal Power Dynamics

In Moroccan culture, there tends to be status and elitism toward certain individuals or groups based on many factors including but not limited to economic status, religion, language adoption, and more.

The social structure in Morocco is mainly based on the economic status of citizens, which has led to social and economic inequality being accepted throughout the country (Every Culture, n.d.). The elite

class consists of the royal family, government members, and a few very wealthy Moroccan citizens. The group between the elite class and those below the poverty line is extremely large. This includes professional workers who are most often educated in Europe and return to Morocco to work (Every Culture, n.d.). Also, there are many individuals who, regardless of their education level, make enough money to get by but have very little room for extravagant purchases. On the lower levels of the economic statuses are those individuals who are very uneducated and do not make enough to meet their basic needs. The wealth gap we see in the United States is not a stranger to Morocco and the economic status of a citizen holds a lot of weight in the social structure as well.

Often, western-style education is held in a higher regard than the traditional public systems. Education status can also often be determined by the language a citizen speaks. Traditionally, Arabic was the only language taught in schools, but the modern education style is bilingual due to French colonization, teaching in both Arabic and French (Boufous & Khariss, 2015). Anyone who speaks French well is considered to be in the higher brackets of society, while those who speak little to no French are lower (Every Culture, n.d.). This is because those who speak French were assumed to be raised in a household with educated parents or were educated in a more formal school. While this doesn't mean that anyone who cannot speak French well is uneducated, it is still construed that the education the individual received was of a lower quality.

2.2.2 Power Dynamics within Moroccan Higher Education

As explained above, there are distinct attitudes toward higher education in Morocco which led to power dynamics between students and educators in Moroccan universities. Professor-student relations in Moroccan higher education institutions are very different from these relationships in other countries worldwide. Morocco's cultural environment and atmosphere play a significant role in this, making meetings between the two parties very formal and structured. In the United States, it is common to eat or drink during class or use the period between classes to eat a snack. In Morocco, this is never done because it is seen as offensive to the teacher (Schools Abroad Handbook, n.d.). The Moroccan way of interacting with faculty in a classroom setting is more formal than what is typically seen in Western Education. Moroccan students are expected not to question the opinions or views of their professors or talk with them about subjects not relating to their course (Schools Abroad Handbook, n.d.). It is also commonplace for professors to openly disagree with a student. This is not personal as it may seem in Western education; it is simply a norm of the education system.

There are sometimes student issues with the way professors deliver their course material, leading to a strained relationship between them. Most students feel that professors are unhelpful due to the fact that they don't change their course delivery throughout their years of teaching. There is little that can be done

about this because academic freedom is limited in Morocco. So professors cannot tailor teaching styles to students or stray much from the curriculum they are mandated to teach (Brosseau, 2000). However, this does not mean there is no wiggle room for professors to adapt their classes to students' preferences. Using different teaching styles, professors can change how they deliver the material to students. This has led to a stronger relationship between professors and students, as students are given all the required material but are given a chance to learn it through multiple teaching styles. Students preferred professors who teach with this more modern approach over those whose primary delivery technique was lecturing (Brosseau, 2000).

These professor-student relationships between student and teacher may seem unimportant to an unknowing party, but they can substantially impact student and teacher performance. Students who were happier with their professors and had strong relationships often report they are more motivated to complete their work to the highest quality and feel like they can ask for help (Brosseau, 2000). A study done in 2020 asked students in a Moroccan engineering university what they believed the service quality of their teaching was. It was found that a large majority felt the quality of service was very poor and needed to be improved (Goumairi et al., 2020). When students feel they are not getting the quality of teaching they deserve, they are not as determined to apply themselves and exceed expectations. They felt that professors should implement more modern equipment, specifically in lab-based classes (Goumairi et al., 2020).

The debate on whether the nature of student-professor relationships is too formal or should remain the same is still ongoing. Those against close relationships between the two parties say that it is too difficult for professors to maintain a tight relationship with all their students, and this closeness might be construed as harassment or favoritism between students. Those who are for a close relationship argue that all humans have emotions, and a stronger connection between students and teachers leads to stronger performance by both groups and increased motivation (Chibani, 2015). Although changes are slowly being made, a more formal relationship between teachers and students in higher education will most likely continue. Professors aim to adapt their teaching styles to make students more comfortable and motivated, which might appease both sides of the argument for the time being.

3.0 International University of Rabat

The International University of Rabat (UIR) is a private university located in Morocco's capital of Rabat. The 66-acre campus offers amenities, including a sports center, indoor pool, restaurants, and several student dormitories. Among its four colleges, the College of Engineering and Architecture, College of

Management, College of Humanities, and the College of Health, the University offers students twelve multidisciplinary schools and 25 accredited programs. In addition, Faculty-Led Programs, also referred to as "Customized Programs," are offered during winter, spring, and summer breaks from the traditional semesters, which allow students additional opportunities to earn credits toward their degree.
For students that desire global travel, the UIR offers numerous opportunities, including to the University of Nantes located in France, Mississippi State University in America, and more (*UIR – Université Internationale de Rabat*, n.d.).

The university's mission is "to produce and transmit knowledge and values for future societies". Currently, they work to accomplish this by maintaining their commitment to trailblazing education, establishing research programs, offering extracurricular activities, and developing students into responsible citizens (*UIR – Université Internationale de Rabat*, n.d.). Additionally, their vision is "a world-class African University" which they strive to achieve every day though adoption of learning models that comply with international standards, incorporating African academic standards, establishing strong partnerships with other African universities, and recruiting students to attend their university from other African countries (*UIR – Université Internationale de Rabat*, n.d.). Our team plans to embody the university's four values, excellence, citizenship, respect, and innovation, throughout our time working with UIR.

3.1 Programs Within the College of Engineering

The College of Engineering and Architecture is one of the five academic organizations offered at the International University of Rabat. Within the College, the following programs are offered: Aerospace Engineering, Automotive Engineering, Computer Science, Energy Engineering, Architecture (*UIR – Université Internationale de Rabat*, n.d.). This IQP project evaluated four of these five programs as the Architecture program is not looking to become ABET accredited.

The Computer Science (CS) program is the largest of the programs offered at UIR with over 650 students enrolled. It offers the opportunity for students to enroll in the specialized programs of Big Data & Artificial Intelligence, SSI (Sécurité des systèmes d'information), and ISI (Ingénierie des systèmes d'information). (*UIR – Université Internationale de Rabat*, n.d.).

Energy Engineering, the smallest school of the programs evaluated, has approximately 300 students enrolled. In this program, courses are strategically tailored to allow students to develop a holistic understanding of several facets of the energy source sector. This knowledge can be applied post-

graduation to help create solutions for energy needs both in Morocco and around the world(*UIR – Université Internationale de Rabat*, n.d.).

The Aerospace Engineering program couples the theoretical training needed to understand the complexities of the growing aeronautics sector in Morocco with technological research allowing those who enroll to become next-generation innovators in transportation (*UIR – Université Internationale de Rabat*, n.d.). UIR's Aerospace program is unique due to English being the language of instruction.

Lastly, the Automotive Engineering program is a mechanical and metallurgy intensive program that gives students the ability to delve into the production and maintenance of vehicles and their components. Combined, the Aerospace and Automotive Engineering programs have approximately 480 students. For our project, we analyzed the Computer Science and Energy Engineering programs independently, however, the Aerospace and Automotive Engineering programs were assessed as one. While Aerospace and Automotive will seek separate accreditation, we evaluated them together because the students enrolled in these programs take nearly identical courses for their first three years of university.

Although these three programs are prestigious as they stand today, gaining the highly coveted ABET accreditation for the programs will reaffirm the quality of their programs and indicate that the graduates of said programs meet the standards outlined by employers in Morocco and around the world. In addition, the accredited programs will better produce and transmit knowledge and values that will be valuable for society, aligning with their mission (*UIR – Université Internationale de Rabat*, n.d.). The School of Computer Science and Digital Sciences director, Professor Mohammed Boulmalf, is spearheading this quest for the programs to obtain ABET accreditation.

3.2 Introducing Professor Mohammed Boulmalf

Professor Mohammed Boulmalf, the Director of the School of Information and Digital Sciences, has previously overseen an ABET Accreditation at another Moroccan institution, Al Akhawayn University in Ifrane. Al Akhawayn University now has three accredited programs, Computer Science, Engineering Management, and General Engineering. Professor Mohammed Boulmalf is seeking to utilize the knowledge acquired through aiding these programs towards receiving accreditation status for programs within the College of Engineering at UIR. He is jointly helping UIR prepare to undergo the ABET accreditation process for Automotive Engineering, Aerospace Engineering, Energy Engineering, as and Computer Science programs. He has called upon Worcester Polytechnic Institute students to aid in this endeavor. In 2021, Professor Boulmalf sponsored a team of five students on a project entitled Assisting the International University of Rabat in Attaining ABET Accreditation. Through this work, the team

created deliverables and recommendations for the sponsor to help align course outcomes with ABET's student outcomes and program educational objectives within the Computer Science program. This year, we will further this endeavor through our own methods and collected data. However, since our current project is so closely related to the one completed in 2021, it will be essential to understand the limitations and setbacks the 2021 team faced to mitigate these same obstacles when completing our project.

3.3 UIRs Recent Efforts toward ABET Accreditation

In 2021 an initial evaluation of the Computer Science program was performed. The Computer Science program curriculum was analyzed from stakeholders' perspectives to understand the relationship between experiences and outcomes. Additionally, the team employed Bloom's Taxonomy and the IRE system to map the alignment of ABET student outcomes to course outcomes.

The findings and recommendations made by the team last year allowed the UIR to alter a portion of its once-current methods of operation to better align with ABET standards (Perez et al., 2021). One of these changes was obtaining the funding for and constructing two new technological laboratories on campus, one specializing in Big Data and the other for Cyber Security. In addition, ABET Accreditation committees and subcommittees also established a standardized course syllabus template. Although performing different methods to evaluate programs within UIR's College of Engineering, our team utilized some of the same tools employed by the 2021 IQP team throughout our project.

3.4 Background of Methods and Tools

The following subsections outline the background on the methods and tools adapted from the previous IQP team and those implemented by our team this year.

Bloom's Taxonomy and the IRE System

Bloom's Taxonomy is a tool that is used to categorize educational goals. Professors worldwide are often encouraged to use it when creating their syllabi to ensure that all program objectives are being outlined (Spindler, 2019). In 2001, a team consisting of cognitive psychologists, researchers, and curriculum theorists published a revision of the original categories of the taxonomy. This updated version is broken down into six classification levels: Remember, Understand, Apply, Analyze, Evaluate, and Create. These categories are based on the cognitive level that is needed to perform them successfully. We utilized the taxonomy to compare the level of the courses to the level of the taxonomy that was displayed by the verbiage of the course outcomes. This tool goes hand in hand with the IRE system, which stands for Introduce, Reinforce, and Emphasize. Program evaluators at universities often use these two tools together to complete curriculum assessments (*Assessment & Evaluation | Sheridan Center | Brown*

University, n.d.). The IRE tool was created at the University of Rhode Island by Dr. Heidi Hayes Jacobs to map curricula. According to the University of Rhode Island, an outcome falls under "I" when it introduces a concept for a program outcome. The second level of the tool, "R," is present when a course reinforces an idea and assists with the understanding of a course outcome. Finally, a course that displays "E" emphasizes the outcomes of a program and advances mastery of a certain level (University of Rhode Island, n.d.). Each level of Bloom's Taxonomy aligns with a level of the IRE system, as shown in Table 1 below.

Introduce		**Reinforce**		**Emphasize**	
Remember	Understand	Apply	Analyze	Evaluate	Create

Table 1: Indicating the relationship between the IRE system and Bloom's Taxonomy (M. Boulmalf, personal communication, 2021).

Standardized Syllabi

The ABET Accreditation Committees at UIR established a standardized course syllabus last year. This standardized format was utilized in all four programs that our team worked with. Table 2 on the following page outlines the typical components of the syllabi we evaluated, however the actual contents differed from syllabus to syllabus.

Syllabi Sections	Description of Syllabi Section
General Course Information	Information such as Course ID, Course Name, Credit Hours, Contact Hours, Semester/Year, Instructor/Coordinator, Prerequisites/Co-Requisites.
Catalog Description	A general overview of what the course covers.
Required Materials	Textbooks, Video Links, etc.
Course Goals	Different from the course outcomes, these are broader statements about what a student will be able to do upon completing the class.
Course Outcomes	Specific outcomes created by the instructor that should directly correlate to ABET Student Outcomes and describe what the student should be able to do upon completing the class.
Topical Outline	A brief outline of the topic covered in each week of the course.
Assignments & Lab Exercises	A section detailing the specific projects, assignments, labs, etc. that students are expected to complete during the duration of the course.
Grading Breakdown	The evaluation items included in the student's final course grade and the weight they carry.
Academic Honesty	A brief description of instructor expectations and a reference to the UIR's Honesty in Academics Policy.
Outcome Mapping	A section intended to show where each course outcome aligns with the ABET student outcomes and on what level of the Bloom's Taxonomy.

Table 2: Standardized Syllabus Sections & Contents

Inter-Rater Reliability

Inter-rater reliability (IRR) refers to the percentage of total agreement existing between subjective ratings given by independent raters after assessing the same material. The equation to calculate IRR is shown below, where TA indicates the total number of agreements between raters, TR is the total number of ratings given by each rater, and R is the number of raters, in our case, three.

$$IRR\ \% = TA \div (TR \times R) \times 100$$

An acceptable inter-rater reliability score is greater than 80%. Assessing the inter-rater reliability denotes consistency among multiple raters and the rates they give (Hallgren, 2012). Although IRR can't prove that the rating is done correctly because it is subjective, it shows that the raters understand how to rate, and their ratings can be considered reliable.

Stratified Random Sampling

Stratified random sampling produces samples that more accurately represent a population then those chosen using a simple random sample. To carry out a stratified random sample, the population must first be divided into subpopulations, or strata, based on demographic identifying information that may have an impact on the individual's perspectives and experiences (Bakiev, 2011). Once strata have been established, a simple sample, or a random selection of entities, is conducted on each of the strata.

CHAPTER TWO: METHODOLOGY

This chapter discusses the methodology our team used to achieve our project goal. First, we detail the processes we created and followed to complete our two objectives. Then, we present the tools we developed and used to complete the evaluation.

1.0 Project Goal

The project goal was to complete an initial ABET accreditation audit for UIR's Computer Science, Aerospace, Automotive, and Energy Engineering programs while providing recommendations on implementing sustainable processes.

2.0 Project Objectives

In order to achieve our project goal, we developed the following objectives.

1. Evaluate syllabi for the Aerospace Engineering, Automotive Engineering, Computer Science, and Energy Engineering programs to assess their alignment with ABET Accreditation criteria.
2. Understand stakeholder's perspectives and experiences through conducting interviews and distributing surveys to identify themes and additional areas of improvement.

Our team aimed to complete our goal through direct and indirect evaluations. Objective one focused on direct evaluation of course materials, specifically syllabi. This included a general analysis of formatting, completeness, and contradictions in course syllabi as well as the more in-depth assessment of the alignment of course outcomes and student outcomes. Objective two helped complete our evaluation with indirect techniques of assessment using surveys and interviews. This process focused on four UIR stakeholder groups: students, faculty, alumni, and employers. The process of syllabi evaluation and the survey creation, distribution, and analysis is outlined in this chapter along with the selection of interview candidates and questions.

OBJECTIVE 1

For this objective, we completed three reviews. Our team analyzed the Computer Science and Energy Engineering programs independently, and as we discuss in the Background Chapter, the Aerospace and Automotive programs were assessed as one. We then used the review to assess each program's alignment with ABET accreditation criteria.

These overarching steps provide a summary of the process taken to complete objective one:

1. Complete a general format analysis of the provided syllabi, examining each section's contents for missing data, format discrepancies, and other variations from the standardized format.
2. Utilize the IRE System and inter-rater reliability to perform an in-depth analysis of the Outcome Mapping Section of the course syllabi, verifying the alignment of ABET's student outcomes to the course outcomes created by the course instructor.

Syllabi

The following subsection details the specific methods of examining the course syllabi we collected from the department heads of each program. In total, we used this evaluation procedure for 103 syllabi (7 Computer Science syllabi, 29 Energy Engineering syllabi, and 67 Aerospace/Automotive Engineering syllabi).

General Format Analysis & Examining Section Contents

As mentioned in Section 3.4 of the Background Chapter, the four programs we evaluated have a standardized syllabi template including various sections that encapsulate everything a student would need to know about the course they are taking. As a first step in evaluating the syllabi, we performed a general examination of the contents of each section. We looked them over simultaneously to note where sections were incomplete, missing entirely, or sometimes, where they varied greatly from the standardized syllabi format. The team identified how instructors generally formatted the syllabi sections in a bulleted fashion, paragraphs, or in a visual representation. If a syllabus stood out due to formatting, the lack of contents, or the confusing nature of any given section, we then flagged that file for future reference.

The team then created three program-specific files that listed all inconsistencies found through the examination of section contents. From there, we analyzed the information to make inferences about where course instructors may not have a clear understanding of what those sections should entail.

Examining the Alignment Between Course Outcomes and Student Outcomes

As discussed in our background chapter, ABET outlines student outcomes within both engineering and computing programs. These describe what a student should understand, be able to explain, and do upon graduation. Ideally, each course outcome developed by an instructor will correlate to at least one student outcome. The following subsections describe the tools and methods we used to align outcomes and correctly map them within the syllabus.

Creation of Outcome Mapping Tool using the IRE System

The other aspect of syllabi evaluation was the creation of an outcome mapping matrix. Our team created this tool in order to complete an in-depth analysis of the Outcome Mapping section of the syllabus. This section describes the creation of the tool, its application, and how our team drew conclusions from it.

The Outcome Mapping section of each syllabus is very intricate and, unlike the other sections, could not be assessed by a simple visual analysis. An evaluation like that would not be advantageous in this section, as UIR faculty members have a less unified understanding of how to map their course outcomes. Therefore, our team manually examined each syllabus individually in greater depth. This more extensive process included an evaluation of each course outcome itself for correct language and use of IRE verbs. Additionally, we reviewed each course outcome for alignment with each student outcome outlined by ABET. Lastly, if a course outcome and student outcome did align, we needed to indicate the specific IRE Level that the alignment fell under.

For each level of the IRE System, there is a list of verbs that demonstrates the cognitive levels needed to successfully master a topic. This indicated whether the outcome was introducing, reinforcing, or emphasizing the topic and allowed us to correctly map each outcome. We analyzed the amount of course outcomes that aligned with each student outcome and the distribution of this alignment throughout the years of each program.

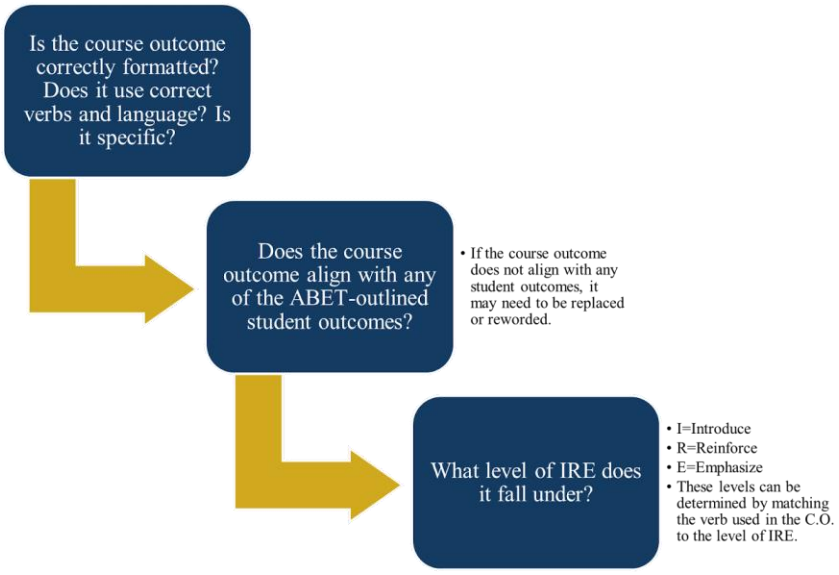

Figure 6: Process of Mapping Individual Course Outcomes to Student Outcomes

As this evaluation is multifaceted, it was imperative to create a tool to streamline and standardize the process. After researching other course outcome matrix mapping tools developed by other universities, our team created a tool that could be used for evaluating the programs at UIR.

Figure 7 below provides a visual representation of our team's matrix and outlines the positioning of ABET student outcomes, course outcomes, and the notes section within it. When a user downloads the template, the ABET student outcomes for each program are already provided within the uppermost row. Course outcomes must be manually inputted in the leftmost column. Then, the IRE level has to be determined by verbs used in the course outcome. I, R, E or a combination of them must then be placed in any cell where a course outcome aligns with a student outcome to denote this level.
This mapping tool allowed us to easily identify the gaps within courses and programs, ultimately pinpointing specific areas instructors needed to improve upon. First, these maps showcase the number of courses that introduce, reinforce, and emphasize a particular topic. Additionally, this matrix tool allowed for incomplete or unincluded wording within instructor course outcomes to be identified by our team. For example, if a syllabus indicated that students would be partaking in a team project yet ABET Student Outcome 5 was not denoted on the matrix, alterations would need to be made to the course outcomes. Doing so allows both students and an ABET accreditation team to more clearly understand each course's content and expectations.

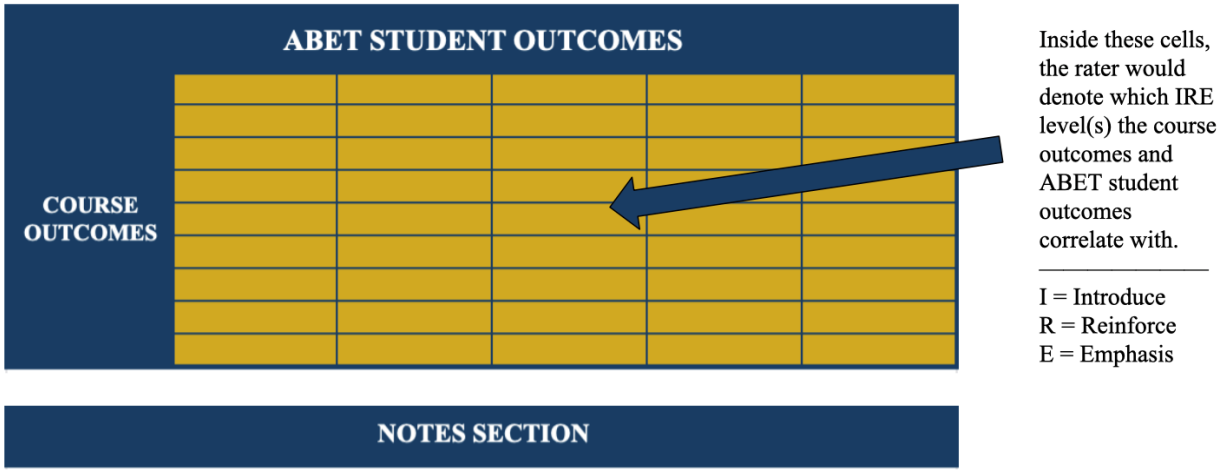

Figure 7: Outcome Mapping Matrix Template

Each member of our team individually reviewed each course, filling in the course mapping matrix. Then, we compared our matrices and discussed any areas of inconsistency. This process aided in the creation of one final mapping matrix for each course. As we compared our individual reviews, the inter-rater reliability (IRR) score was calculated to indicate consistency among the raters. To do this, we created a tool in Excel that automatically calculates the percent agreement between raters. An agreement refers to

whether a pair of raters indicated an alignment of a course and student outcome. For the use of our tool, if a pair of raters agreed, a "1" is denoted while a "0" indicates disagreement.

Figure 8 below provides an example of inputting "0" or "1" to indicate the agreement between a pair of raters. For the course outcome included, all raters agreed that it correlated to the first student outcome. However, for the second student outcome, Rater 1 and Rater 2 agreed on the alignment but Rater 3 did not. This process is completed for the alignment of each course outcome to each student outcome. The IRR tool automatically calculates the score for each row. Additionally, the average IRR score is calculated for the entire course and is inclusive of all course and student outcome ratings.

Course Outcome #1: Describe accurately the operations of optical systems			
Student Outcome #1: Ability to identify, formulate, and solve engineering problems by applying principles of engineering and mathematics.	**Rater 1 /Rater 2**	**Rater 2/Rater 3**	**Rater 1/Rater 3**
	1	1	1
Student Outcome #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	1	0	0

Figure 8: Example of Indicating Agreements/Disagreements in IRR Tool

In conclusion, the process to complete objective one was two-fold and the analysis our team did on the syllabi sections, specifically the outcome mapping, gave us an in-depth look at the specifics of each program. The direct evaluation we completed in this process led to many findings and recommendations for improving the programs. To ensure we had a holistic picture of each program, we also developed a second objective to identify the indirect evaluation of a program's success.

OBJECTIVE 2

Evaluating the syllabi from each program within the College of Engineering offered insightful information about the direct measures of program alignment with ABET accreditation standards. However, our team still wanted to investigate each program's success through an indirect evaluation. The perspectives and experiences of students, faculty, alumni, and employers were collected and analyzed.

Figure 9 below shows some of the things we expected to learn from surveying and interviewing the stakeholders.

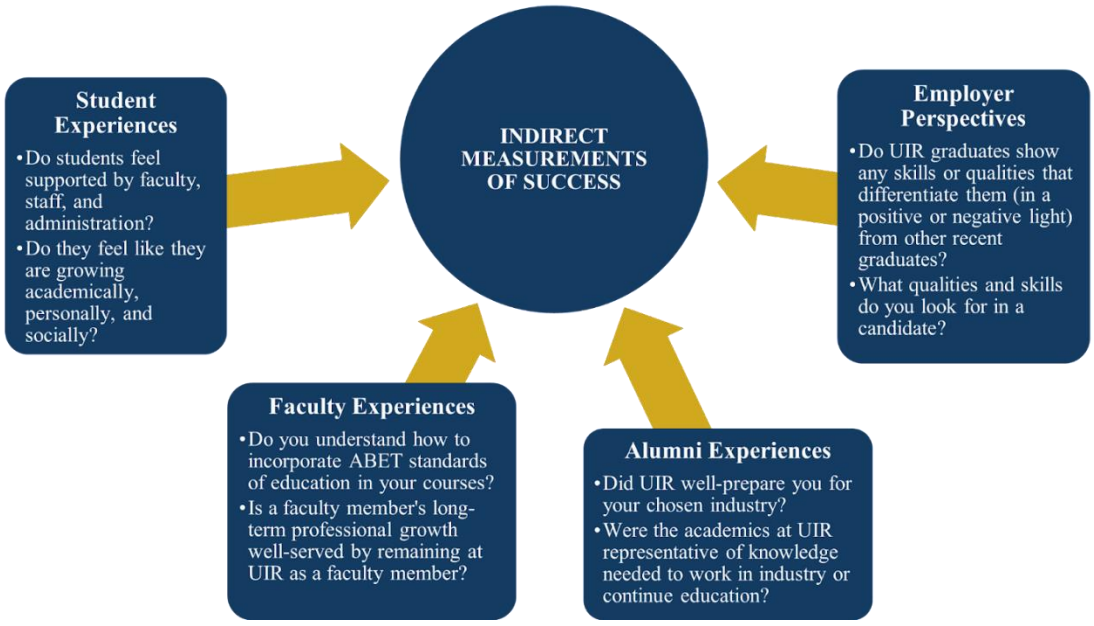

Figure 9: Examples of Indirect Measurements of Success Broken Down by Stakeholder Category

Surveys

This subsection details the development methodology, distribution process to students, faculty, alumni, and employers, and the data analysis completed on each survey after they were closed for further submissions. Table 3 below details all the surveys we created and distributed to UIR stakeholders, the languages they were offered in, and the period in which responses were collected.

SURVEYS DEVELOPED AND DISTRIBUTED TO UIR STAKEHOLDERS			
	STAKEHOLDERS	**SURVEY LANGUAGES OFFERED**	**DATES RESPONSES WERE COLLECTED**
COMPUTER SCIENCE	Student Survey	English, French	April 13-April 27
	Faculty Survey	English, French	April 13-April 27
ENERGY ENGINEERING	Student Survey	English	March 28-April 26
	Faculty Survey	English, French	April 12-April 27
AEROSPACE & AUTOMOTIVE ENGINEERING	Student Survey	English	April 14-April 27
	Faculty Survey	English, French	April 12-April 27
NON-DEPARTMENT SPECIFIC	Alumni Survey	English, French	April 13-April 27
	Employer Survey	English, French	April 13-May 5

Table 3: Surveys Developed and Distributed to UIR Stakeholders

Survey Development

The primary motivation for creating and distributing surveys to UIR students, faculty, alumni, and employers was to obtain quantitative data to make general assumptions about each stakeholder category. We developed the surveys in Qualtrics, an online tool that our team accessed through WPI credentials. Survey questions were designed based on the surveys sent out by a 2021 Interactive Qualifying Project team who did a similar evaluation of UIR's Computer Science program. Using their surveys, our team kept a similar structure and wording of specific questions but added and removed additional questions based on our project's areas of interest.

Student surveys focused on students rating their ability to perform each ABET student outcome and their feelings toward UIR's environment, academic support, etc. Faculty members were surveyed about how well they feel their students are being prepared and the inclusion of ABET standards into course planning. Alumni were asked mostly open-ended response questions to better understand their individual experiences in their chosen program and any areas they believe could be improved within the program. Lastly, the employer survey was centered upon the abilities of UIR students in industry and their

performance in comparison to other graduates in their field. Table 4 below details the question types utilized in the development of the surveys.

Question Type	Example
Open Ended Response (Long or short)	How many years have you taught at UIR?
Yes/ No Statements	ABET Curriculum Requirements Yes / No I have received substantial coverage of at least one general-purpose programming language
Multiple Choice Statements	Gender Male Female I choose not to disclose this information
Frequency (Always, Often Never)	Please read the statements below that describe environments that may be present when working in a computing lab. How often is this environment fostered within the Cybersecurity Laboratory? Never / Often / Always Working in this laboratory inspires me to have deeper intellectual thoughts Student-to-student interaction is encouraged
Scaled Ratings (N/A, 1-5)	**ABET Student Outcome 1:** Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. N/A = Not Applicable / 1 = Very Poorly / 2 = Poorly / 3 = Enough / 4 = Satisfied / 5 = Very satisfied Ability to combine mathematical and/or scientific principles to identify and formulate engineering models or problem Ability to apply principles and perform calculations either by hand or by calculating devices to solve the problem

Table 4: Survey Question Types with Examples

The team utilized open-ended responses, multiple-choice, yes/no statements, and matrices to display questions to respondents. Individual matrices were created for topic-specific content, and respondents

were asked to respond with either a rating on a scale of one to five or a frequency rating. Lastly, in the Statement of Consent provided before any questions were populated, we reminded respondents that the completion of the survey was not mandatory, their identity would remain anonymous, and they could stop at any time if they no longer wanted to participate in the data collection.

Finally, once the surveys were designed using Qualtrics, our team worked with Professor Anass Sebbar to translate six of them into French. As discussed in the background section of this report, language is a highly complex topic in Morocco, and, in higher education, it is often found that French is still the primary language of instruction. The Aerospace & Automotive Engineering and Energy Engineering program's student surveys were the only surveys developed exclusively in English, as it is the language of instruction.

Department heads looked over their program's surveys for approval. After minor edits, the surveys were distributed to the appropriate stakeholders in each department.

Survey Distribution

All surveys were distributed through email using a link to the Qualtrics survey. This was the most reliable, feasible option for distributing the surveys to a large number of faculty and students at UIR as well as alumni and employers who were located throughout the country or even the world. The emails were sent by faculty or assistants within each program to the students multiple times throughout each survey's response period. Additionally, two graduate students, Sarah Lahlou and Oumaima Fadi aided in the distribution of the employer survey.

Survey Data Analysis

After survey responses were collected, the team downloaded the raw data from Qualtrics and performed data cleaning methods to remove any responses with substantial amounts of incomplete or incorrectly filled data. Our team utilized Microsoft Excel to organize the data into categories relating to different ABET areas of evaluation. We filtered responses to each question by class year, specialty, and gender to evaluate responses in various demographics as well as the program as a whole. Faculty responses were also filtered depending on whether they were full-time or part-time employees. We then used the organized data to make visual representations of the information we collected. These visual representations contained a consistent formatting and color scheme to be easily understood in the program-specific reports given to each department. Lastly, we evaluated the data we had collected and the visuals we created to pinpoint major findings or trends amongst the stakeholder categories.

Interviews

This subsection covers how we interviewed UIR stakeholders from the creation of questions, through the random sampling method used to select candidates, and the tool we created and referenced to analyze all the data we collected.

Interview Candidate Selection

The intended goal of our team was to interview a select number of individuals to make inferences about the population of stakeholders they belonged to.

The large number of students enrolled in each program made it easier for our team to conduct a random sample and meet with selected students. We planned to meet with 5% of the students in each program thus conducting a stratified random sample to randomly select students within each class year.

Figure 10 below shows the calculation table created by our team for the Energy program. This can serve as an example that can be replicated during future evaluations. After we determined the number of interviews needed, we used a random generator to select students who we then contacted to sign up for an interview with our team.

Year	Number of Students	Percentage	# Of Interviewees Needed	# Of Interviewees	# Of Interviewees plus 3 in case of nonresponse
First Year	41	17.45%	2.09	2	5
Second Year	52	22.13%	2.66	3	6
Third Year	76	32.34%	3.88	4	7
Fourth Year	66	28.09%	3.37	3	6
Total	235	100.00%	12	12	24
Our team is looking to interview 5% of students. Therefore, we hope to interview 12 students.					

Figure 10: Stratified Random Sample Example Calculation for Energy Engineering

While random sampling was more realistic for student stakeholders, as there are between 300 and 600 students enrolled in each program, it was not as feasible for faculty, alumni, and employers. Therefore, we did not conduct random sampling, and we met with any person in these three stakeholder categories that was willing to interview with us. Our team decided that because these interviewees were self-selected, the opinions are not representative of all UIR College of Engineering faculty, alumni, or employers. However, they gave us valuable insight as to where UIR is excelling and the areas it could improve upon.

Selection of Interview Questions

Our team conducted interviews to learn specific information about the stakeholder's experiences and perspectives. We selected primarily open-ended questions and conducted interviews in a semi-structured format. This allowed interviewees to lead the conversation with whatever information came to mind or what they felt was most important to share with our team. The final interview questions, found in Appendix C, were outlined by or adapted from both the ABET Accreditation Board and the Planning Accreditation Board (PAB) (ABET, n.d.; *Site Visit Interview Book*, 2015).

Since we interviewed many individuals from different backgrounds and ages, we developed a set of questions for each stakeholder group. These focused on the program specifics that directly impacted or involved them. Lastly, in each stakeholder category, we grouped questions together by topic to make thematically coding the interviews easier.

Thematically Coding Stakeholder Interviews

Our team developed a thematic coding template as a uniform way to analyze the information gained from interviews with students, faculty, alumni, and employers. This template can be used to find the common experiences and perspectives within a stakeholder group. To do this, we took possible answers to interview questions and grouped them into umbrella terms which serve as the "thematic code". In Figure 11 below, we have included a segment of the student interview coding template we created and used for this project. Our full thematic coding templates for each stakeholder group are included as a Deliverable 5. These templates can be used to replicate the thematic coding of future interviews.

Topic	Questions	Thematic Code	Examples
Opening Questions	**Why UIR?**	Referred	Family/ Parents
			Family Friend/ Friend
			Alumni
			Random
		Academics	Teaching Language
			Major
		Proximity	
		Status	
		Other	Other

Figure 11: Thematic Coding Interview Template Example

Below, Figure 12 displays the process used to format a sample response into a thematic code. Note that responses can fall into multiple umbrella terms/overarching categories. We thematically coded each interview question so that the responses of all stakeholders in each program could be easily compared and themes could be identified. After the completion of all interviews, we used the coding documents to compile findings and recommendations for the Aerospace Engineering, Automotive Engineering, Computer Science, and Energy Engineering programs.

Figure 12: Examples of Thematically Coding Interview Responses

In summary, our second objective of interviewing and surveying stakeholders was crucial in understanding the stakeholder's different experiences. We used these methods of collecting data to complete indirect evaluations of each program. We then translated that information into findings and therefore made recommendations to further improve stakeholder experiences in the future. Because this was a qualitative assessment, it was important to understand the environment we were working in and the limitations of our project, some of which are discussed below.

3.0 Project Limitations and Considerations

Cultural Considerations

Language

As discussed within the Background chapter of this report, the lasting effects of French Colonization are still very present in Morocco, including the complexity surrounding language. For this reason, during interviews we encouraged stakeholders to express their thoughts on a certain prompt or topic in the language(s) of their choosing if they are having trouble expressing their thoughts in a language they are less familiar with. On the provided interview signup sheet, interviewees had the ability to select the

language they wished to conduct their interview in. Our project advisor, Professor Mohammed El Hamzaoui, offered to serve as an unbiased translator, if any stakeholder selected French as their preferred language. It was important to our team to choose a translator that was unaffiliated with UIR to allow greater transparency and security for those sharing their experiences.

Ramadan

Our team had the opportunity to complete our project during the holy month of Ramadan. It is a period centered around an individual working to become closer to God through fasting, prayer, reflection, and more. The month of Ramadan began on April 2, 2022 and concluded during our final week in Rabat. This meant a considerable amount of our project was conducted within this period. Our team was cognizant of the effect of this month on the stakeholders, specifically because the UIR education system mirrors that of the French and thus does not necessarily align with shifting culture during Ramadan. Due to this, our team ensured to be patient with members of the UIR community, eat and drink in private locations, and were mindful of the shift in the workday as the UIR operated from 9 AM - 4 PM.

Differences in Higher Education

All members of our IQP team grew up in the United States and are used to Western education ideals. While Morocco and North Africa are slowly adopting some of these practices, our team did encounter differences in professor-student dynamics, student expectations, etc. We took this into consideration when carrying out the objectives detailed above and understanding the limitations of implementing certain recommendations.

In addition, our team has a different perspective on the transition from high school to college than many of the students at UIR. In Western culture, it is common for students to have the autonomy and independence to choose which college to attend and program to pursue. Our team found this was not a universal phenomenon as many students expressed in interviews that their parents or guardians have a significant influence, in some cases choosing every aspect of a student's university experience entirely. Additionally, parents also maintain a large role in their child's academics, unlike what we are used to, as they are contacted by UIR if a student is not successfully meeting their expectations. It was important for us to be cognizant and sympathetic to these experiences when discussed.

Limitations to Our Project

Survey Development, Approval, and Distribution

One limitation to the results of our methodology was the time it took to have our surveys approved and distributed to stakeholders. We originally planned to have surveys sent out during the week of March 28

to April 1. However, lack of timely review and approval ended up pushing this date back, and most surveys were sent out with limited time for collecting responses. This may have impacted the number of responses we received from stakeholders; however, we still obtained adequate response rates, with the lowest being 18.82% of usable responses.

The Energy Engineering program approved and distributed the survey to their students very early on, allowing the survey to remain open for twenty-two days. This was reflected in their response rate of over 55%.

Availability to be on Site

Since our project team was located in the Hassan area of Rabat, there was some limited access to the UIR campus in our first two weeks of project work. Until April, there was no consistent transportation provided to us, so we could only be on-site two days a week.

Interviewing Randomly Selected Students

Our team faced difficulty interviewing the randomly selected students as many never signed up for an interview with our team. However, we were able to meet with a considerable number of class delegates who spoke on behalf of all the students in their program's class year.

CHAPTER THREE: FINDINGS

1.0 Introduction

The goal of our project was to evaluate the Computer Science, Energy Engineering, Automotive Engineering, and Aerospace Engineering programs within the College of Engineering and Architecture at the International University of Rabat. This evaluation was completed to discover, within each program, what operations align with ABET Accreditation standards and find areas of improvement that the programs can implement to better align with them. Our team created the following two objectives to successfully complete our project:

1. Evaluate syllabi for the Aerospace Engineering, Automotive Engineering, Computer Science, and Energy Engineering programs to assess their alignment with ABET Accreditation criteria.
2. Understand stakeholder's perspectives and experiences through conducting interviews and distributing surveys to identify themes and additional areas of improvement.

This chapter outlines the findings and recommendations that surfaced through our evaluation of the programs. In Objective 1, we primarily discovered lack of consistency in syllabi, inaccurate mapping of course outcomes to student outcomes, and incorrect usage of IRE verbs. In Objective 2, stakeholders shared various aspects of their experience, both positive and negative. Faculty members often showed a misunderstanding of the benefits of ABET Accreditation. Students and alumni both voiced a desire for more hands-on experience in laboratories that is representative of industry practices and standards. Additionally, while students feel prepared to continue their education and/or work locally or globally, they often do not get exposure to post-graduate opportunities or connections with industry professionals. In the following sections, we describe these findings in greater detail, provide supporting evidence, and propose recommendations for improving each area.

2.0 Findings Related to ABET Standards and Practices

2.1 Faculty's Lack of Understanding Surrounding ABET

When our team arrived on site at the International University of Rabat, we did expect some faculty opposition in regard to the emerging accreditation efforts. As discussed in the Background Chapter, our sponsor and advisors were wary about this as well due to the resistance last year's IQP team faced while working with the Computer Science department. What we did not expect to find at the university was a welcoming set of department heads and faculty members who were ready to support our project and give

any information or materials we needed. The real problem lies in the faculty's lack of understanding of the ABET accreditation benefits. Our team found that this lack of understanding and lack of the resources to learn more contributes greatly to the reluctance of faculty members to adjust their courses to align more with accreditation standards.

Recommendation

The faculty's lack of understanding will greatly impact the willingness to adopt any other recommendations made for each program, so a precedence should be set on addressing it first. Our team recommends explaining ABET and its benefits to faculty members, hearing their concerns, and answering their questions about accreditation and its processes before expecting them to support all the changes. This implementation could take time, but seminars on accreditation efforts, infographics, or other means of conveying this information could be greatly beneficial in continuing the efforts of improvement within each academic program.

Once faculty members are well-versed on what the accreditation process entails and the direct benefits they will see in the future, our team believes that opportunities to practice course outcome creation and syllabus development in the French language would be well-received. We offer this suggestion in hopes of increasing the faculty's understanding of ABET and, in turn, their willingness to adapt their course structure and methods of assessment.

2.2 Alignment of Course Outcomes and Student Outcomes

After analyzing and mapping the syllabi, our team recorded multiple findings regarding course outcomes (COs) and their alignment with ABET's Student Outcomes (SOs). There were many instances of poor phrasing and grammar within the COs and incorrect mapping of CO and SO alignment on syllabi, with instances of overemphasizing some SOs and not emphasizing others. The following sections outline all of these findings related to course and student outcomes and give recommendations of areas to change and improve upon.

2.2.1 Discrepancies within Course Outcomes

Throughout the syllabi that our team evaluated, there were many discrepancies and problems that we identified among course outcomes. The verbiage of many of the COs was the biggest inconsistency that we found during our analysis. While there were multiple course outcomes in every program that were well written with proper grammar and phrasing that correctly aligned with multiple student outcomes, this was not the case for the majority of them.

The full compilation of data for every program and more targeted findings is found in the program-specific reports, Deliverable 5. These reports outline each area of improvement our team found that is specific to the program we were evaluating and didn't fall under general findings.

The number of course outcomes was a prevalent issue, especially in the Aerospace and Automotive Engineering syllabi. The preferred number of COs for a course ranges roughly from three to five, depending on the nature of the course and how many student outcomes it aligns with. Taking this into consideration, there were multiple courses within this program that had ten or more COs on the syllabus. In instances where there were too many course outcomes (five or more) we also made suggestions in the Formal Syllabi Notes (Deliverable 6) on how to cut down on the total amount of COs. There were multiple courses with COs that were similar and could be combined into one outcome. An example of this from the Aerospace and Automotive Engineering program is shown in Figure 13 below. The first CO was very similar to the second one, using most of the same language and it appeared repetitive. Our team suggested combining these two outcomes into one, therefore cutting down on the already exorbitant number of COs and removing the repetition.

CO1: Solve problems of kinematics involving **rectilinear** motion of particles.
CO2: Solve problems of kinematics involving **curvilinear** motion of particles.

↓

"Solve problems of kinematics involving rectilinear and curvilinear motion of particles"

Figure 13: Combination of Course Outcomes Example

While it was less common, we did find multiple course outcomes that did not map to a single ABET Student Outcome. ABET outlines that while not every single CO needs to map to most or all of the Student Outcomes, it is important to map to at least one, and aligning with two or three is preferred. Another common issue that our team found within the syllabi was the phrasing and grammar of the COs. While there were many courses with COs that were clear and concise, a majority of them had incorrect grammar and phrasing that was very vague and misleading. Due to this, understanding the meaning of the outcomes was difficult for our team, which in turn made it more complex to map the COs and SOs. This is in part due to the language barrier as discussed in our background. Because English is usually not the first language for students or professors, it is sometimes difficult to directly translate from one language to another. This is very important in the Aerospace, Automotive, and Energy Engineering programs as their language of instruction is English.

When talking with faculty in interviews, we specifically asked how professors typically create their course outcomes, and we received varying answers. A majority mentioned that they have no assistance with creating the COs and just look at the course topics and generate outcomes from there, while a few mentioned that they use the structure outlined in the required textbook or materials for their course.

Ultimately, only one of the nine faculty we interviewed about outcome creation told us they use the ABET Student Outcomes and course topics hand in hand to ensure all aspects of the course are covered and the COs align with multiple SOs.

Recommendation

When a course outcome doesn't align to a single student outcome, we recommend that that CO be reworded so that it does align or removed from the course outcomes completely. While it is difficult to map courses that aren't engineering based to the ABET Engineering Program Student Outcomes, there still should be alignment to at least one SO to show that the course is aiding in the overall growth of the student towards the accredited degree. For instance, non-engineering courses have the opportunity to align with Student Outcomes 3, 4, and 5 as they have components including communication, ethical judgment, teamwork, etc. Additionally, we recommend instructors use our Formal Syllabi Notes ,Deliverable 6, to make changes to their COs, editing grammar and word choice.

2.2.2 Incorrect Mapping of Outcome Alignment

Although many professors attempted mapping on their syllabi, our team found that this was seldom correct. On the syllabi there is no explanation of the Student Outcomes, which does not ensure that all professors completely understand them. Multiple syllabi in each program did not even attempt to map the Course and Student Outcomes, or only mapped some of the COs. In other cases, professors showed alignment between every single CO and SO, which is very rarely the case. Ultimately, faculty do not have a consistent understanding of what it means for course outcomes to align with Student Outcomes, and therefore incorrectly map their COs on the course syllabi.

Recommendation

Our team was made aware that the Energy Engineering program has created video tutorials on how to map course and student outcomes for faculty. During our interviews with professors, we were told that these videos were very informative and helpful to give a better understanding on mapping outcomes. We recommend that these videos be recreated to fit the Aerospace & Automotive and Computer Science programs and distributed for faculty to watch when creating their syllabi.

2.2.3 Student Outcomes Distribution and Inconsistencies

When analyzing the syllabi and mapping the course outcomes to the Student Outcomes required by ABET, our team found that the distribution of their alignment was very uneven. Throughout all three schools, a majority of the COs aligned with Student Outcomes 1 and 7, with minimal alignment to the other six SOs. In the syllabi we were given from the Energy Engineering and Computer Science programs, there was zero alignment with certain SOs. Analyzing each individual school, we found that

the degree of the issue differs. Figure 14 shows the Total Student Outcome alignment in the Aerospace and Automotive Engineering School. As is the case for all TreeMaps, including the one below, the size of the block indicates the frequency of alignment.

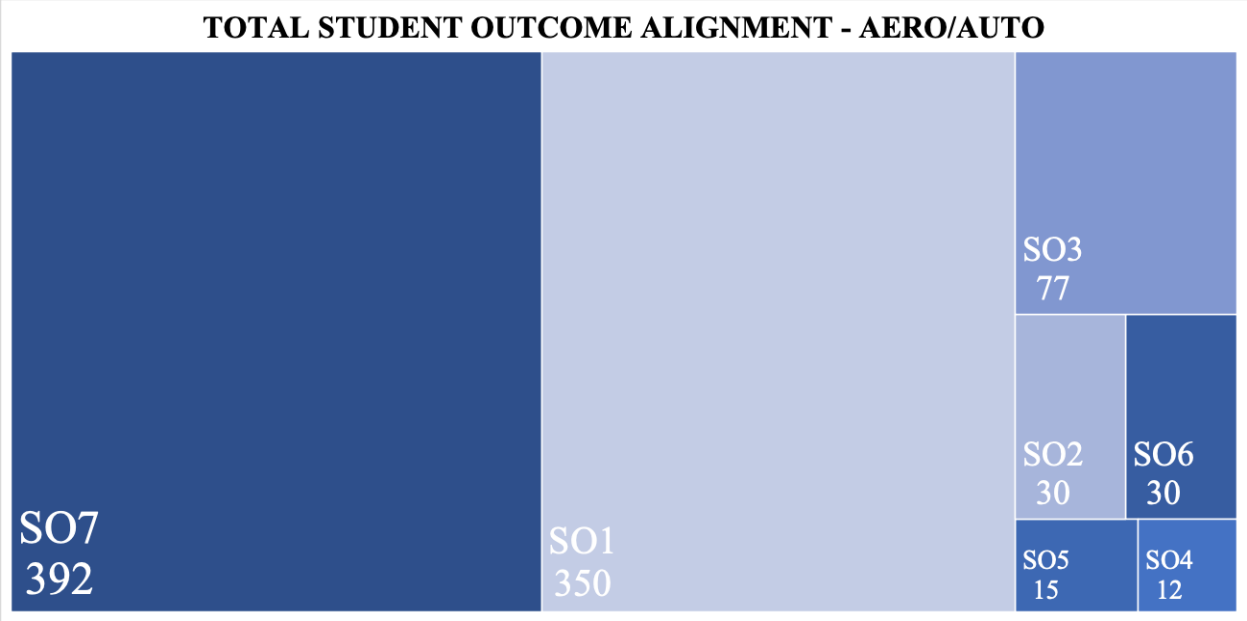

Figure 14: The Total Student Outcome Alignment within the Aerospace and Automotive Engineering Programs

As the chart shows, Student Outcome 7 appears the most with a total of 392 COs aligning with it, which amounts to 88.89% of all the COs for the Aerospace and Automotive programs. Comparing this to the other SOs the imbalance is clear, especially when looking at Student Outcomes 4 and 5 which align with only 2.7% and 3.4% respectively, of total course outcomes created by instructors within the Aero/Auto program. We also analyzed the programs by year to see if there was a difference in the Student Outcomes represented. Figure 15 below visually displays the Student Outcome alignment with all of the COs in courses taught in year two.

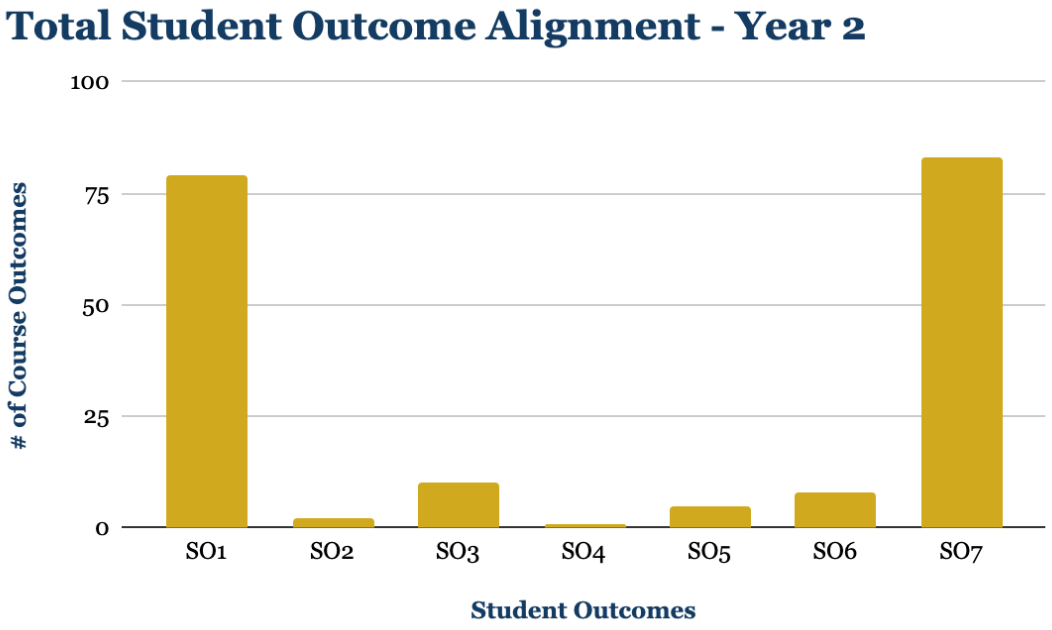

Figure 15: Total Student Outcome Alignment within Year 2 in the Aerospace and Automotive Engineering Program

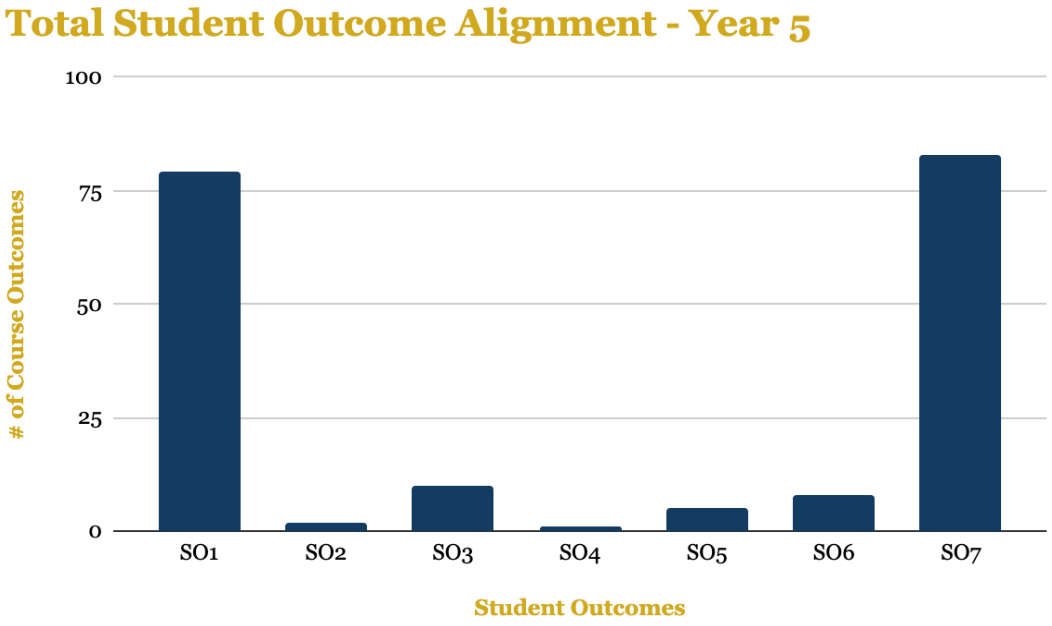

Figure 16: Total Student Outcome Alignment within Year 5 in the Aerospace and Automotive Engineering Program

Comparing this to Figure 16 which shows the SO alignment for year five, our findings are very similar. Both charts show that Student Outcomes 1 and 7 are heavily emphasized while the other SOs are barely present. Student Outcome 6 shows alignment with multiple COs but is still much less prevalent than SOs 1 and 7. Because the yearly breakdown in these figures does not show sizable differences compared to the

evaluation of the entire program, this implies that the uneven distribution of Student Outcomes occurs throughout a student's entire academic career rather than individual years.

The drastic difference in breakdown is not only apparent in the Aerospace and Automotive school, but the Energy Engineering program also saw similar results. Figure 17 below depicts the alignment with Student and course outcomes for the Energy school.

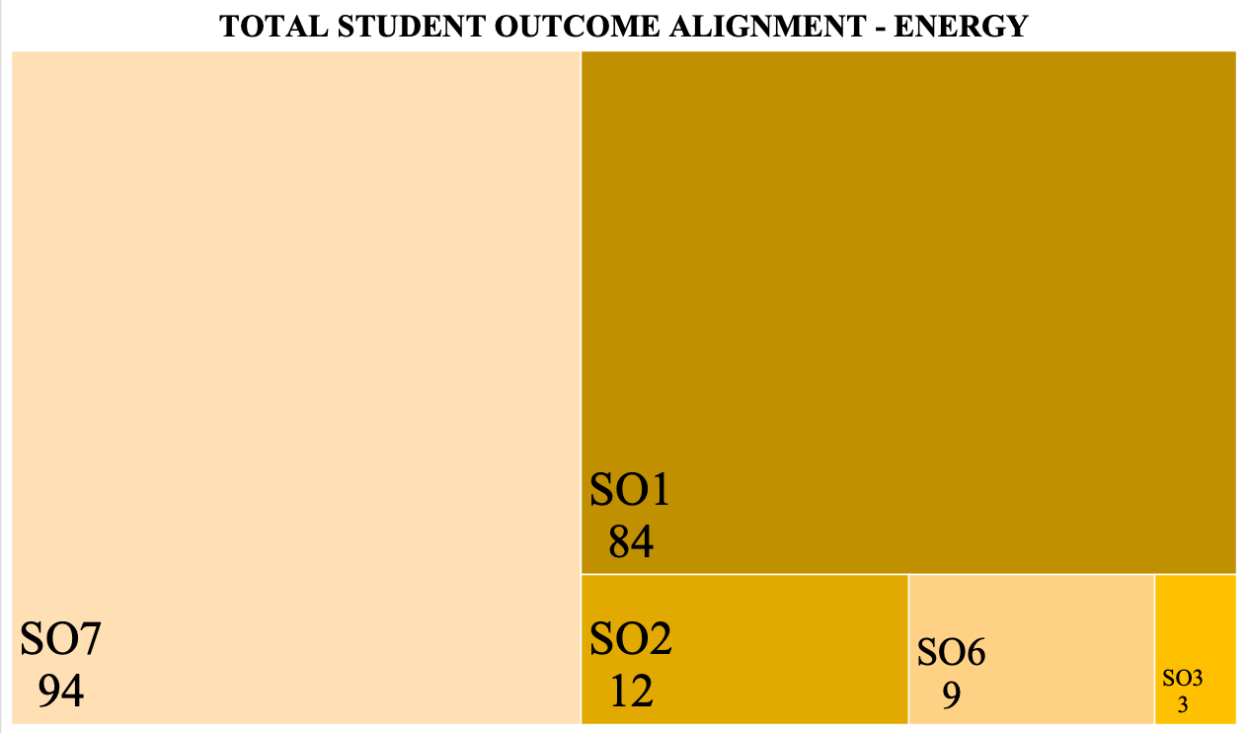

Figure 17: The Total Student Outcome Alignment within the Energy Engineering Program

Similar to the issues found in the Aerospace and Automotive school, a majority of the COs align with Student Outcome 1 and 7. A total of 88.42% of COs align to Student Outcome 1 and 98.95% align with Student Outcome 7. The Energy program alignment appears worse than the Aerospace and Automotive alignment because as the figure shows, there is no alignment with Student Outcomes four and five from any of the syllabi we were given to analyze. While the alignment appears worse than the Aero/Auto program, it is important to note we were given significantly fewer syllabi from the Energy department. If an evaluation was done of more course syllabi, the findings would likely indicate a better alignment with Student Outcomes than our findings represented above.

Our findings for the Computer Science program are very similar, although it cannot be directly compared due to the fact that the Computer Science program needs to align with different Student Outcomes than the two engineering programs. There are six ABET computing SOs instead of seven, but our findings are similar with Student Outcome 1 and 6 for the Computer Science School. Looking at Figure 18 below,

85.19% and 77.78% of COs align with Student Outcomes 1 and 6 respectively, which is significantly more than the other SOs.

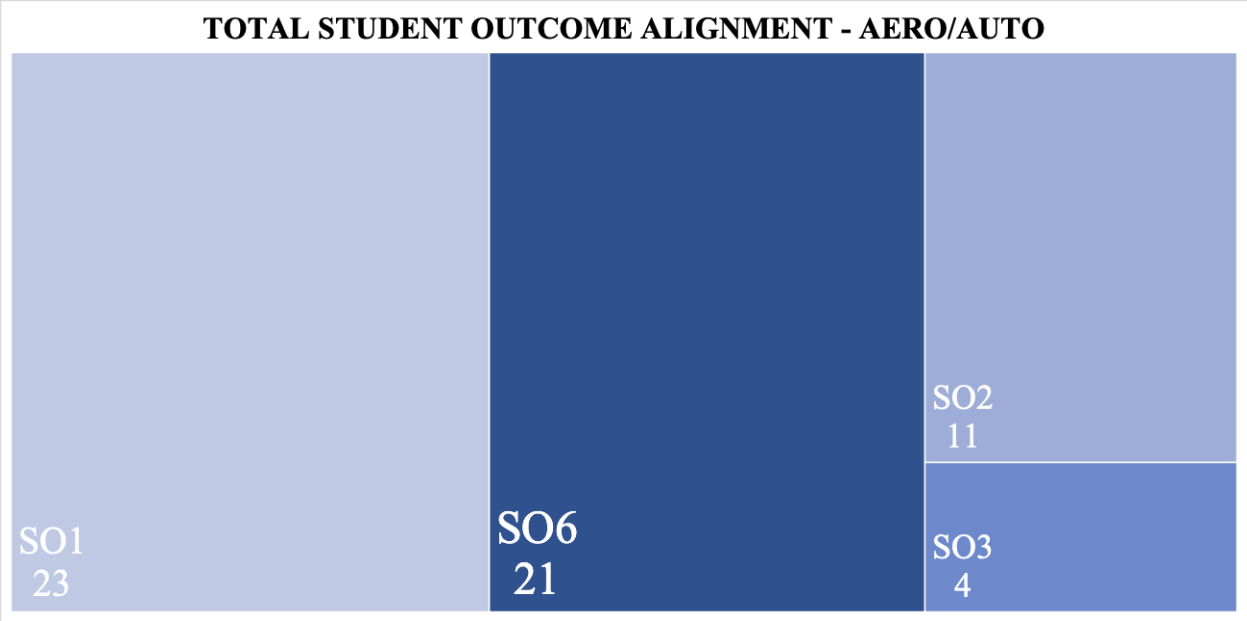

Figure 18: The Total Student Outcome Alignment within the Computer Science Program

Once again, some SOs are completely unrepresented, in the case of Computer Science these are Student Outcomes 4 and 5. Overall this alignment is unacceptable according to ABET standards as it is expected that all Student Outcomes are demonstrated throughout the entirety of a program as mentioned previously in the background section. Additionally, our team was only given seven syllabi from the Computer Science program which indicates that our findings are not representative of the program's true operations. We strongly recommend an evaluation is done of all course syllabi to correctly portray the distribution of Student Outcomes throughout the five years of the program.

Another prominent issue that our team detected that goes hand in hand with the uneven distribution of Student Outcomes is the inconsistencies between aspects the syllabi indicated are incorporated within the course and what was actually mapped to the SOs. This case was the most common in terms of Student Outcome 5, which is based around teamwork. There were a large number of instances where a course's syllabus specifically mentions teamwork or group assignments as an aspect of the course, but that is not reflected in the COs, therefore not aligning with Student Outcome 5. While it might seem obvious to a professor that teamwork is a part of the course, the COs are not reflecting that therefore when an ABET accreditation team begins evaluation, they will immediately note that professors are not aligning their COs with a majority of the Student Outcomes, therefore they are not meeting the requirements of accreditation.

Recommendation

In order to correct these course and student outcome alignment issues, the course outcomes must be rewritten in each individual syllabus to ensure that courses are focusing on more than just SOs 1 and 7. Once again the Formal Syllabi Notes for each program located in Deliverable 6 provide specific phrasing suggestions that fully encapsulate the components of a course within its COs.

A specific example from an Energy Engineering school syllabus is shown in Figure 19 below. The syllabus notes that this experiment is done in a group and consists of a final presentation, but due to the verbiage of the CO it only correlates to Student Outcomes 1, 6, and 7. Expanding the CO slightly to include all aspects of the experiment, as shown below, the outcome would then align with SOs 3 and 5 as well as SOs 1, 6, and 7.

CO1: "Design and conduct experiments and basic data analysis based on heat transfer measurements"

↓

"Design and conduct experiments and basic data analysis based on heat transfer measurements **and explain the process and findings in a group oral presentation**"

Figure 19: Increasing Student Outcome Alignment Example

This is also a recommendation to rectify the other finding of inconsistencies between the syllabi and COs. Ensuring that there is verbiage specifically mentioning aspects of each of the SOs that a CO aligns with is crucial.

During faculty interviews, our team specifically asked participants if they thought the course outcomes they created aligned well with ABET Student Outcomes, and their answers varied. A majority said they believed their COs did in fact align with ABET SOs, but when asked what the Student Outcomes were, they could not name them. Although this doesn't mean they are incorrect about their CO alignment, it does show that the understanding of what it means for COs and SOs to align is somewhat lacking and can be improved.

2.2.4 Adoption of the IRE System within UIR's College of Engineering

The IRE system, as discussed in our background and methodology, was a crucial part of our analysis of course syllabi and outcomes. The set of verbs that correlate with IRE and Bloom's Taxonomy are meant to be used when creating course outcomes, giving a way to map the cognitive level needed to complete each course. In some cases, a course outcome clearly aligned with a Student Outcome, but the IRE level could not be denoted as the CO contained no verb correlating the IRE System.

When interviewed, professors gave very little indication of understanding what the IRE system is or its uses. Out of the nine faculty interviews we conducted, only one faculty member knew what IRE stood for and how to apply it to course outcome creation. Additionally, it should be noted that this faculty was also the only one who understood CO and SO alignment. There is a small blurb on the bottom of the syllabi below course mapping where IRE is broken down to give professors a better idea of how to use it when mapping their COs, but the explanation itself is incorrect. On the syllabi it is laid out as seen below:

I= Introduce (Weak), **R**= Reinforce (Intermediate), **E**= Emphasize (Strong)

This explanation does not accurately describe the levels of IRE due to the connotation of each level with a degree of "Strong" or "Weak". Course outcomes that Introduce topics and align with the I level are not weak COs, they are simply introducing a subject using I level verbs. Students are expected to understand these topics and describe them, but nothing more. It is important to have I level COs in classes that introduce topics as most disciplines build on the information students are taught previously.

In some cases where the IRE verbs were used, they were not used correctly, or there were more appropriate verbs to use instead. One example of this is shown in Figure 20 below. The verb "demonstrate" is an IRE verb that correlates to the R level of the system, but it was often used incorrectly before the verb that was actually appropriate.

Original CO: "**Demonstrate an understanding of** the principles of heat transfer"

↓

Revised CO: "**Understand** the principles of heat transfer"

Figure 20: Rewording Course Outcome with Proper IRE Verb Example

In this example, "demonstrate" is not the correct verb, "understand" is, and in the original CO "demonstrate and understanding of" should be removed and replaced with "understand" followed by the rest of the outcome. There are many different variations of this happening throughout the course outcomes, and all recommendations on how to fix these are outlined in the Formal Syllabi Notes in Deliverable 6.

It was much easier for our team to map the alignment between Student and course outcomes for the courses that used the IRE verbs. But after analyzing the spread of Is, Rs, and Es for each course, we found there was a very uneven distribution throughout the years of each program. When an ABET evaluation team is looking at a program, they want to see first and second year courses mainly introducing and beginning to reinforce ideas, and as the courses get harder and more major-specific, the course outcomes should mainly reinforce and emphasize topics. But this was not displayed in the programs we evaluated.

As shown in Figure 21 below, the distribution of IRE levels throughout the five years within the Aerospace and Automotive engineering programs is very uneven.

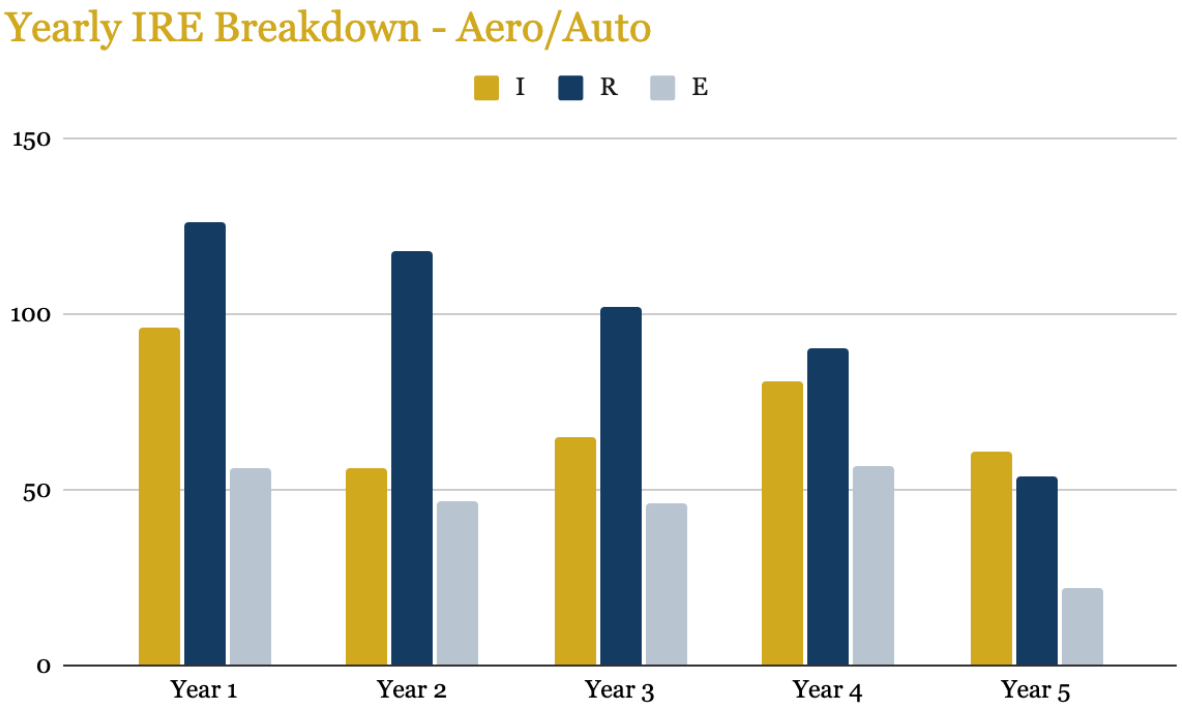

Figure 21: Yearly IRE Level Breakdown within the Aerospace and Automotive Engineering Programs

As the figure above shows, a majority of course outcomes are reinforcing topics for the first four years, and in the final year there are more outcomes that are introducing topics than any other level. The level of emphasizing topics should slowly increase throughout the program, whereas in the figure it is staying relatively stagnant and even decreasing in year five.

An example of an ideal IRE yearly breakdown is shown below in Figure 22. This graph shows how Is, Rs, and Es should be distributed throughout the years of a program. Level I should be largely used in the first two years, steadily decreasing as courses get more major-specific and complex. Level R should begin slightly lower than I, with a slight peak in the third year and marginally decreasing throughout the remainder of the program. Finally, Level E should be used very rarely in the first two years, steadily increasing to be heavily used in the final year.

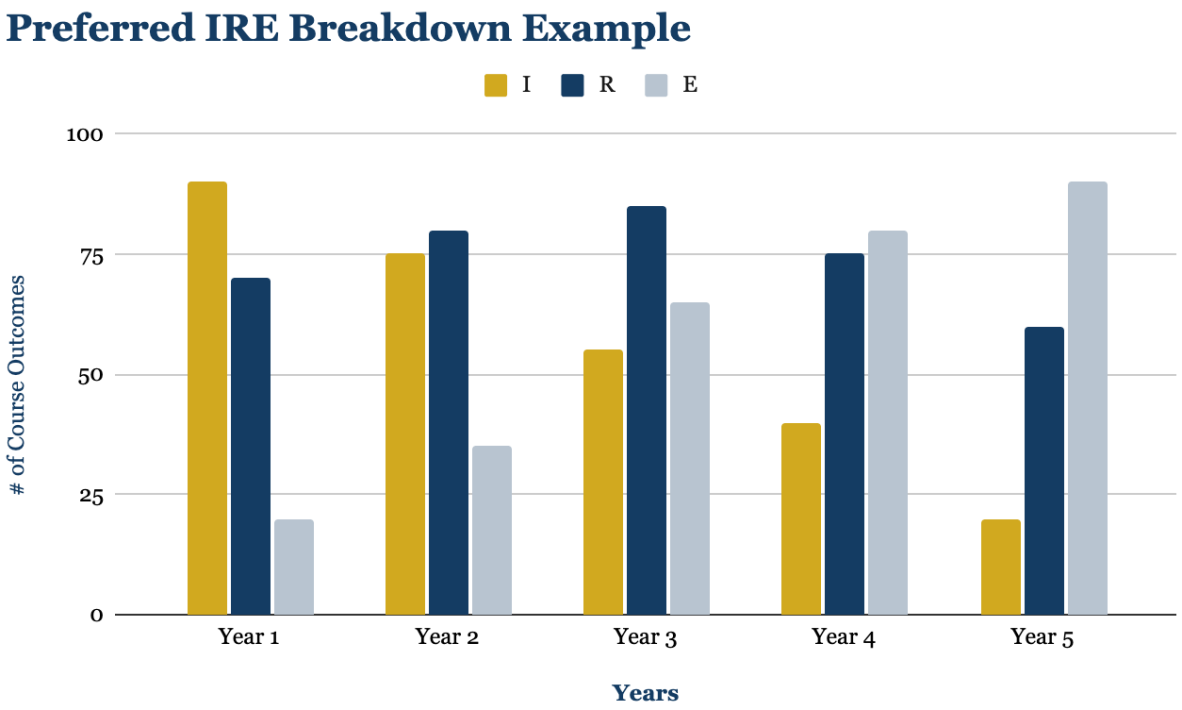

Figure 22: Preferred IRE Breakdown Example

This issue is not only apparent in the Aerospace and Automotive Engineering school, but the Energy Engineering school is also facing a similar problem. As demonstrated in Figure 23 below, the appropriate IRE level verbs are not being used throughout the program. Our findings from the Energy program are not as uniform as shown in the chart, there seems to be no method to the IRE levels being used. Year one starts with fifty COs being reinforced, while only twenty-one are introduced. There is no steady change in any of the IRE levels throughout the years of the program, the changes are sharp and have little supporting evidence as to why. It should be noted that the data for year five is so drastically less than the other years because we only received one syllabus from that year, as a majority of fifth year Energy students are completing internships instead of taking courses. Due to the limited number of syllabi, the IRE distribution is likely more ideal than what we collected.

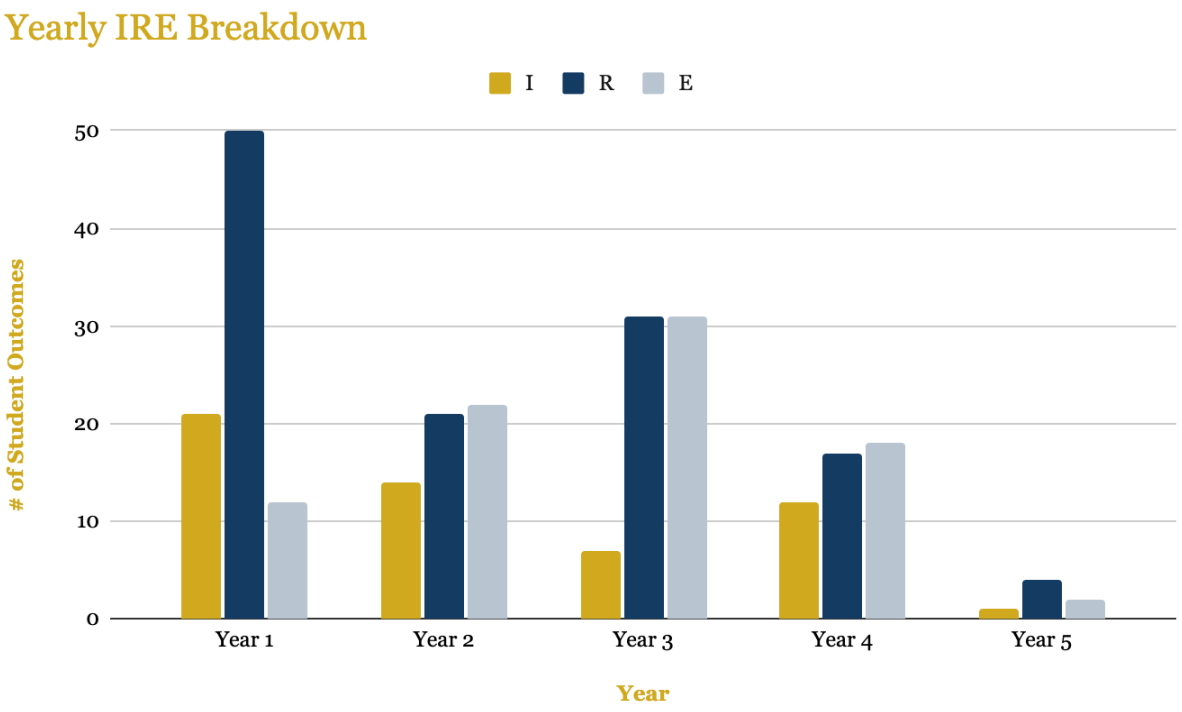

Figure 23: Yearly IRE Level Breakdown within the Energy Engineering Program

Recommendation

In our interviews with Energy Engineering faculty, our team learned that the faculty members for this program have been given a list of IRE verbs to use in course outcome creation, which is very similar to the list of verbs our team compiled. The comprehensive list our team assembled is Deliverable 2 of this report and details the specific verbs and their correlation to Bloom's Taxonomy and the IRE system.

It is our recommendation that the IRE verb list be distributed to all faculty members along with guidelines to follow when utilizing the list. It is important to not only give faculty the list, but also give them instructions on how to implement them in their course outcomes, because only doing the first step will not solve the issues of incorrect verbs.

Our team also recommends that the explanation of I, R, and E on the syllabus should be changed to remove "Strong," "Intermediate," and "Weak" while keeping the meaning of IRE. Below is what it should be changed to.

I= Introduce, **R**= Reinforce, **E**= Emphasize

In order to better align with ABET standards, our team recommends looking at the verbs used in the course outcomes and making sure they are the appropriate IRE level. Focusing on starting with a majority

of topics introduced in the first and second years, then steadily decreasing through the remainder of the program would better represent the goals of the program. Doing the opposite for emphasizing, starting lower than the other two levels and steadily increasing through the fifth year, would accomplish the same. This is another instance where the Formal Syllabi Notes, Deliverable 6, is beneficial to use to help professors choose the appropriate verb and rewrite their course outcomes accurately.

Ultimately, there are many areas of improvement within the Course and Student Outcome alignment section of the syllabus. A majority of these can be remedied by utilizing the Formal Syllabi Notes deliverable that is discussed throughout this section. Taking into consideration the notes and suggestions made within that document will benefit the professors and lead to more concise and correct course outcomes, along with better alignment with ABET Student Outcomes.

2.3 Lack of Syllabi Consistency

Through an analysis of the general contents within each syllabus, we found ourselves having to flag more errors than we originally anticipated. Essentially our team found that, while programs have a standardized syllabus, instructors lack a cohesive understanding of what content belongs in each outlined subsection. Specifically, our team flagged the most syllabi for inconsistencies within the following sections: General Course Information, Catalog Description, and Course Goals.

Often, the syllabi lacked basic information such as the course ID, credit hours, or the prerequisites required to succeed in the course. The lack of basic syllabi components indicates that faculty members are not dedicating enough time to creating their syllabi or do not having enough time/resources to do so. Additionally, this finding led our team to believe that syllabi are not returned to course instructors and supervisors and directors do not provide professors with feedback on how to improve them. If instructors are given feedback on their syllabi, our team found that it is not edited and the existing, incomplete document is dispersed to students. Furthermore, the same mistakes will likely be made in the development of future syllabi as the feedback was not provided or not reviewed.

The Catalog Description included in the syllabi should offer a general overview of the topics and concepts covered within the course. However, we often came across descriptions that were incredibly vague or were not written at all. Course Catalogs are a great tool for organizing a program’s offerings and showcasing what a student learns within each course. It should be noted that catalog descriptions can likely be recycled for that course once they are created, and instructors would not need to create new ones every semester.

Lastly, the Course Goals section was where the most inconsistencies lied between courses. The formatting of the course goals varied from paragraphs to bullet points, and some were constructed almost identically to the course outcomes. From this inconsistency, we can infer that instructors don't know the difference between the Course Goals and course outcomes needed to be outlined for each course. In fact, our team also had trouble finding a description for what was expected in those sections. Course Goals are more general concepts the course covers and aligns with the Catalog Description while course outcomes specify the direct concepts or actions a student must understand or perform in order to receive a good mark and develop their skills within the ABET Student Outcomes.

Overarching Recommendations for Syllabi Improvement

Based on all the findings described above, our team recommends providing program-specific workshops for faculty members where they learn how to correctly create a course syllabus using the template provided to them. In this workshop, faculty should be given the opportunity to learn what belongs in each section, practice writing and formatting the sections, and given exemplary syllabi to reference and model as they create the documents on their own. In the Formal Syllabi Notes in Deliverable 6, our team noted exemplary syllabi. A few of these include Engineering Drawing II: Modeling and Manufacturing, which is in the Aerospace and Automotive program in the second year, Structural Analysis, and Fluid Mechanics, which are third year courses also in the Aerospace and Automotive Engineering program.

Time should be spent walking faculty through each step to ensure that mapping is done correctly. It is also crucial to give faculty the time and space to ask any questions they have about mapping, so they completely understand the need for it and its benefits. Overall, it would be beneficial to create a condensed guide on how to map COs properly so that professors can have the guide and syllabus side by side while they are mapping.

We also recommend that these faculty workshops are held in both French and English. This is due to the fact that, as mentioned previously, English is not the first language for professors. Giving them an understanding of the student outcomes in French first will ensure that they comprehend all aspects of the outcomes and how to align COs with them, which they can then translate into English on their syllabi.

Most importantly, we recommend that the timeline of syllabus creation and collection be altered with the intention of providing feedback to faculty members about what was done incorrectly on their syllabus and how to fix it. This should be followed up with the expectation of editing the syllabus until it meets the needs expected within each program. Essentially, our team suggests that syllabi are collected a few weeks prior to the start of a semester and reviewed by the instructor's supervisor. Then, it is returned to the

instructor, and they are asked to submit a revised version within a set deadline, before the semester begins.

We make these recommendations in hopes of furthering the benefits of the standard syllabus created last year. While the template exists, it is not currently achieving all it set out to because faculty members do not have standardized directions on the content nor a cohesive understanding of CO/SO mapping. The adoption of these recommendations will benefit the students within each course, as well as the faculty, administration, and future accreditation evaluators.

3.0 Findings Related to Student Academic Experiences

Both project objectives offered insight to our team about the typical experience of a student in the programs we assessed. Accreditation is student-focused thus it is important to understand how students feel the program works for them and the areas they may need more support with. In the surveys distributed to students, they were asked to rank various things including the quality of the education they are receiving. As seen below in Figure 24, students are satisfied with the education they are getting at UIR in their chosen programs. 60% of students ranked the quality of education as “Good” or “Very Good”. The findings and recommendations included in this section, if implemented, will ensure that UIR is putting the time and resources into continuing to provide a high-quality education for their students and shape them into stellar individuals within their industry.

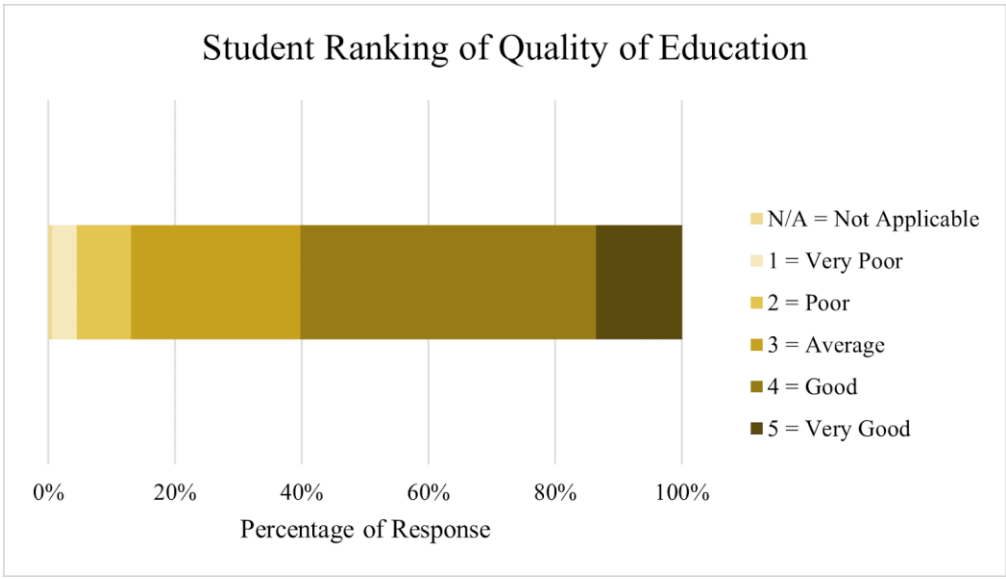

Figure 24: Student Ranking Results of Quality of Education

3.1 Student Workload

One consistent topic of discussion when meeting with students, regardless of their program, was the excessive workload a student carries during a semester. Most students noted this as a weakness within their program or something they would change if they had the ability to. This theme was also present in interviews with faculty members, expressing concern for a student to perform well with so many responsibilities and tasks to complete.

While a college course load is meant to be rigorous, the pairing of requirements set by the Ministry of Education and the expectations of UIR's College of Engineering students is often too much. Some students did note that they felt there were too many general, foundational courses required in their first few years of university. However, the majority of students enjoy the interdisciplinary approaches that the curriculum offers and the opportunity for emphasizing a student's personal growth in the way they learn. Findings from student interviews indicate that the stress a student feels is often due to the amount of work expected rather than the number of courses they are taking. When instructors schedule an exam with only one week of preparation, and a student has project work and other courses to attend to, as well as day-to-day familial and personal obligations, students' plates often become overloaded.

Recommendations

As explained in the Background Chapter, university can only control so much of what a student is required to do, however, university administration should examine the current curriculum and make changes where possible. This could include requiring a period of notification before the administration of an exam or a detailed topical outline of coursework in syllabi so students can prepare at the beginning of the semester.

3.2 Hands-On Learning Opportunities

A great way to break up the day and keep students involved is creating more opportunities for hands-on learning and experience in the laboratory. Many students, alumni, and faculty members also made this suggestion when our team interviewed them. While students in the first and second year get a reasonable amount of lab work and exposure to project teams, this is often not consistent in the later years. Students express concern with their ability to practice the theoretical things they are learning in the classroom with live experiments or demonstrations in laboratories.

Our team believes that UIR's College of Engineering has enough tools and machinery to increase the amount of laboratory work included in courses, especially in the fourth and fifth year. Many students noted the excellence of the equipment in the Technical Hall and the Engineering building, however said they are rarely allowed to use the machinery.

Long-time faculty of UIR who were interviewed also expressed benefits of hands-on learning techniques yet noted that in recent years, it appears UIRs priorities have favored in-classroom learning, whereas years ago, there was an equal effort to invest in practical methods and research as there was in academics. Additionally, there is a disconnect linking the present opportunities to the industry. Alumni and individuals who have completed internships echoed this, as some did not feel the bridge between classroom learning and real-world application was established as they entered the industry without some of the technical knowledge employers and supervisors expect them to know.

Recommendations

We believe that UIR students could greatly benefit from the addition of more lab components and hands-on work. Citing the satisfaction of putting classroom theories into practice, increasing self-efficacy, and ease of learning through dynamic and interactive concepts compared to theoretics, the hands-on and research-oriented work students partake in adds excitement and deviation from workload-heavy days. Often, priority is given to the traditional technical skills within a field. Once a student has mastered those foundational competencies, they should be exposed to new ones. When creating new opportunities, there should be an emphasis on implementing the most recent advances in technology and inclusion of newer techniques needed in the current industry. This will allow for the refinement of both technical and soft skills, including collaboration techniques, learning how to manage projects strategically, and practicing leadership. Opportunities like these ensure that a student knows more than just the basic skills needed for industry and makes them more competitive in post-graduation job markets.

3.3 Industry Exposure

Along with the disconnect present in the alignment of practical methods and industry, our team also found that UIR students feel they lack exposure to industry professionals overall. When speaking with alumni and students who have had internship experience, individuals often indicated their position was found without the direct help or guidance of UIR. In both Figures 25 and 26 below, you can see that alumni indicated they did not have immense support from UIR in finding career related opportunities and did not have many opportunities to connect with employers. While some students have gotten the chance to interact with members of their industry, these opportunities were not provided by university personnel. Students praised the efforts of a club or student organization for the appearance.

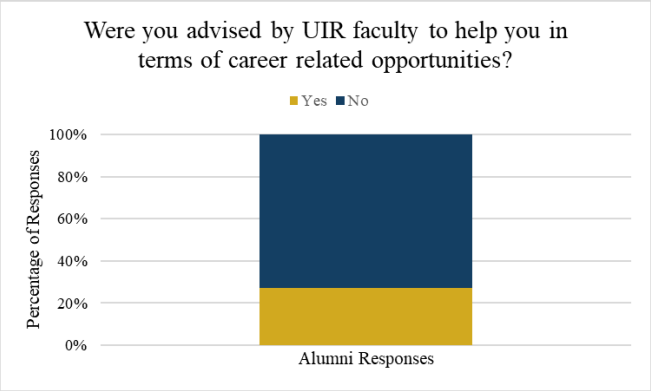

Figure 25: Alumni Responses, UIR Career Support

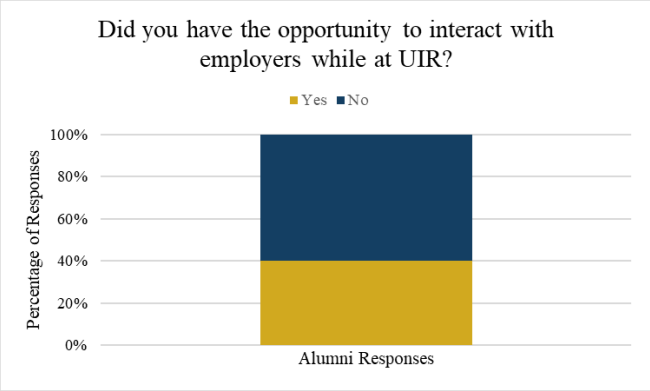

Figure 26: Alumni Responses, UIR Employer Interaction

Recommendations

With the countless number of strong and sustainable academic and industrial partnerships that UIR maintains, our team believes there is a missed opportunity for students to connect with these individuals. There is great value in networking and having an inside perspective into what is currently happening in a student's intended field. As a team, we recommend that the university put more effort into promoting the avenues they have currently established, such Student Life (Service de la Vie Étudiante), an office specializing in assisting students with career development. This department could also host workshops, such as resume and cover letter reviews, which would aid students in creating and compiling high-quality materials that can prepare them to enter the job market. Additionally, having a single database that can house all contact information for the companies that employ UIR students. This would be a resource that could lead students in the right direction as they begin their search for post-graduate opportunities. Similarly, a program alumni list could be a resource available to students that could allow them to gain advice from an individual who was once sitting in the same seats they are now.

Lastly, career fairs held on campus could be another great avenue for UIR to investigate. These events could provide students with more industry exposure, provide information about post-graduate opportunities, and allow for practicing professional communication. Additionally, UIR hosting this event would provide visibility to the university and potentially establish partnerships with various companies interested in hiring students from the College of Engineering. These partnerships would provide long-term benefits for current students and increase the interest from prospective students. As the university establishes its reputation as a leader in STEM education, students around the world will be interested in attending UIR and participating in their innovative programs.

3.4 Lack of Classroom Technology Maintenance & Upkeep

While large efforts are made towards providing faculty and students with innovative machinery and technology, UIR must not overlook the importance of maintaining more basic technologies such as those located within the four walls of a classroom. Students, faculty, and alumni alike indicated that malfunctioning classroom technology, such as projectors, often diverted time that could have been spent learning course material.

Students also appreciate the accessibility of technology infrastructure on campus, like computer labs. Specifically, students like that machines have all the software and tools a student would otherwise have to download and manage on their own device. However, in these areas, students and faculty often shared that keyboards and other computer accessories are sometimes missing, damaged, or faulty. Additionally, software such as those utilized in computer science courses are only downloaded on certain machines and often crash the operating system.

Recommendations

Our team recommends that both the maintenance of basic technologies and the availability of internet and bandwidth are investigated. Once the university has the resources to maintain their current equipment, we suggest they fund more licensing of tools like Python and virtual environments. Both of these software were mentioned by students as something worthwhile for the university to invest in.

4.0 Findings Related to Academic Personnel

4.1 Support from University Faculty, Staff & Administration

As mentioned in Section 3.0 of this chapter, students are satisfied with the quality of education provided by the Aerospace, Automotive, Computer Science, and Energy Programs. This is also the case with student’s attitudes toward the university’s academic personnel.

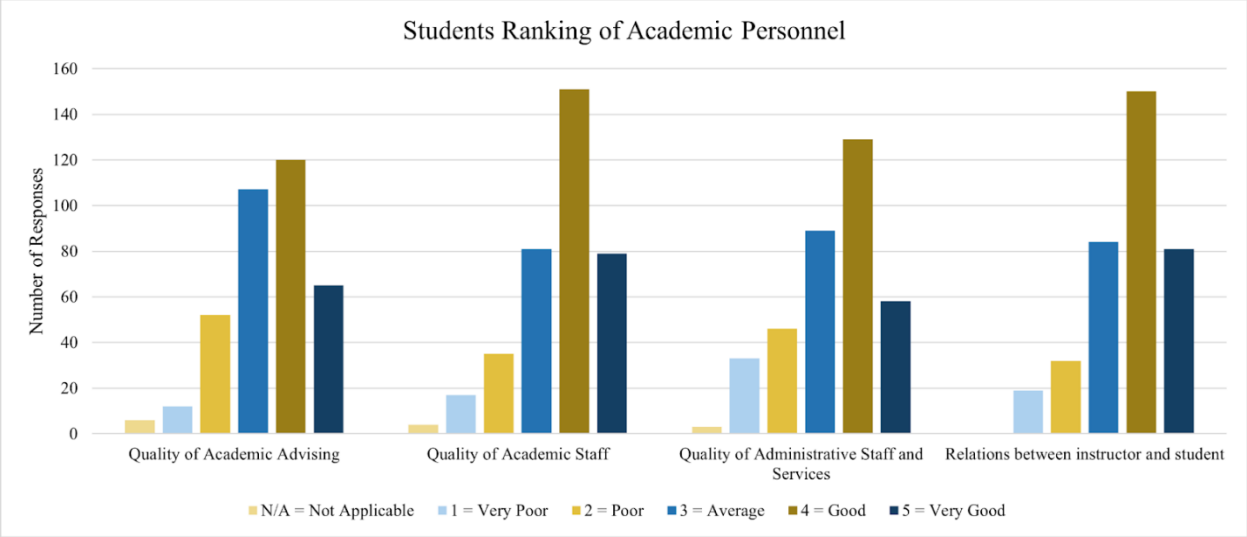

Figure 27: Students Ranking of Academic Personnel

Figure 27 above outlines the survey responses from students where they were asked to rate, on a scale of 1-5, the quality of academic personnel at UIR. A ranking of 1 aligned with "Very Poor" while a ranking of 5 indicated "Very Good". Across all four programs, 82% of students rated the personnel 3 or higher indicating a positive attitude toward those individuals. While there are responses where personnel are rated "Poor" or "Very Poor", the left-skews of the bar graphs above indicate an overarching positive sentiment of the university's' faculty, staff, and administration among the population of students in the Aerospace, Automotive, Computer Science, and Energy programs.

This is a great finding for the College of Engineering and the university as a whole, especially because at the beginning of our time at UIR, it was conveyed to our team that the administration was not supportive of students. In some cases, students shared that their voices were not heard when emailing or approaching administrative staff about concerns within academics, their program, or the university in general. This is an area that administrative staff of the UIR College of Engineering should examine to create improvement measures. This should be done with the intention of better supporting those students that do not feel assisted or backed by the administration. While this does need to be addressed, the survey data did verify that the majority of students in the four programs we evaluated do believe that the quality of administrative personnel is fairly good.

In terms of instructors, students held their faculty in very high regard. All students we were able to interview mentioned the approachability of most faculty members for both academic related inquiries and personal matters. However, in these interviews students often noted that some instructors, while approachable, were not necessarily qualified to teach them. Most of these students elaborated that while

their professors are extremely knowledgeable in their fields, many do not know how to teach the information to those who are not already familiar with the subject matter.

Recommendations

Our team recommends implementing more opportunities for fellow undergraduate students to help fill the gaps where faculty members have a hard time teaching a new concept or skill. Peer-to-peer support and advising may yield better student experiences in terms of better understanding coursework and also engaging with peers in an academic environment. This collaboration will foster a better campus community, allow more reserved students to get involved, and help develop professional communication skills by providing a low-stress environment where students can practice communication skills with other students rather than their faculty members or industry professionals. This may assist students who have a hard time communicating with instructors because there is a larger gap between their levels of knowledge and experience.

Tutoring may also aid in situations where a student has trouble understanding a professor's course materials. When learning from peers, they may be exposed to different learning styles and tools to successfully understand a concept. Often, students may be able to simplify topics in a way that professors cannot. If tutoring and peer learning is received well by UIR College of Engineering students, a space could be designated in Building 2 for this collaboration to happen. This may provide easy access for students to ask one another questions as it would be in the building where many of their classes occur. Additionally, advertising this opportunity and making the space easy to find will not only allow more students to benefit from it but also encourage those who would not seek the help on their own to explore peer-to-peer learning as a method of academic support.

5.0 Summary & Discussion of Findings

The findings outlined in this chapter indicated to our team that a culture of care and collaboration already exists on the UIR campus. However, there are areas that the university must prioritize improving in order to further provide students with a well-rounded, good quality education. The College of Engineering has many strengths and is well-preparing undergraduate students for entering the domestic and global workforce as well as continuing their education. To improve the long-term success of the Aerospace, Automotive, Computer Science and Energy programs, the following areas should be addressed:

- Faculty's misunderstanding of accreditation processes and benefits
- The inconsistent course syllabi format and contents
- The issue of aligning course outcomes to student outcomes and correctly mapping them

- The distribution of student outcomes in each program
- A student's ability to balance academics along with their social and personal obligations
- The frequency of hands-on learning experiences and their correlation to current industry standards
- The support UIR currently offers in searching for post-graduate opportunities
- Student's ability to interact with industry professionals and learn more about the fields they are studying
- The current maintenance and upkeep of basic classroom technology
- Computer systems and software the university currently offers, their effectiveness and current performance, as well as additional software whose investment would better serve students and faculty
- Peer-to-peer learning and tutoring opportunities

CONCLUSION

This chapter will give an overview of our team's general recommendations for all programs and the deliverables that we handed over to our sponsor, Professor Mohammed Boulmalf, for the Computer Science program and to members of the Aerospace, Automotive, and Energy Engineering programs.

Overview of Recommendations

There were several recommendations our team proposed based on the findings discussed in the previous chapter including increasing faculty engagement and support, enhancing student experiences, and utilizing deliverables to improve syllabi and course outcomes.

Due to the many findings regarding faculty's misunderstanding of ABET accreditation, the standardized syllabi format, and how to create and map course outcomes, our team suggests an increase of faculty engagement through workshops. Faculty should be given a concise and clear description of ABET accreditation and its benefits to understand why the programs within the College of Engineering are pursuing it. We propose that these workshops should be held in French and in English so professors are able to understand all aspects in their native language. Based on our team's findings, we recommend giving faculty a space to ask questions to better understand any areas of confusion.

Within these workshops, instructors should give faculty an overview of the standardized syllabi format. We suggest that every step of syllabi creation is walked through by instructors and examples of exemplary syllabi are highlighted, specific course syllabi to use for this are noted in the findings and recommendations section. Furthermore, the correct format of course outcomes and use of IRE verbs within the outcomes should be explained to demonstrate how course outcomes align with student outcomes.

Our recommendation to improve the course outcomes is to utilize the Formal Syllabi Notes in Deliverable 6. As discussed in the Project Deliverables section below, where we recorded recommendations for each individual course syllabus. These documents should be used to address many of the issues outlined in Section 2 of the findings and recommendations chapter, such as improper usage of IRE verbs, incorrect phrasing of outcomes, etc.

Due to our findings regarding the limited career development support and resources around campus, our team recommends major changes be made to improve this aspect of students' experiences. There is a career development office in place currently, so our team recommends that they expand their available

resources to include things like resume and cover letter workshops, interview practice sessions, etc.. that will better prepare students to enter the workforce. Bringing in industry professionals to talk with current students is another recommendation that falls under the career and industry umbrella. Giving students the opportunity to talk to professionals in their desired field of study could help them decide what specific areas to pursue or introduce them to new and advancing fields they hadn't been aware of before. Additionally, we recommend implementing career fairs to showcase local companies that are interested in hiring UIR students. This would also demonstrate the post-graduate opportunities that are available to students.

Our team also recommends that campus facilities and technology be improved and maintained to better both faculty and student experiences. As detailed in the Findings chapter, the Wi-Fi and projector issues within classrooms need to be investigated as this greatly affects the ability of students and faculty to perform efficiently and effectively.

Finally, our team suggests that the hands-on aspects of student experiences on campus need to be improved, which can be done by increasing the number of labs for courses, giving students more research opportunities, and more. It is important to prepare students for the technical aspects of their industry, so it is our recommendation to ensure that all laboratory equipment and technology is up to date and introduce lab aspects whenever possible throughout all five years of a student's academic career. Another aspect of student academics that should be addressed is the workload. Our team recommends that there be a mandatory deadline imposed before all exams, so students have the proper amount of time to prepare for them. Overall, focusing on improving student life academically should be prioritized in order to better student experiences at UIR.

Project Deliverables

The course mapping tool that our team created in Google Sheets to map course and student outcomes will be given to all four programs for future syllabi evaluation and is included as Deliverable 1. We have also created an instruction manual on how to properly utilize the tool. The purpose of this is to aid the programs in completing further syllabi analysis once our team's project is complete.

Another tool that we will be handing over to the departments is the thematic coding tool, Deliverable 4, that our team used to code the interviews we conducted as discussed in the methodology chapter. Once again, we will give an instruction manual for future ABET committees to utilize for conducting interviews. This will help in future evaluations to understand indirect evidence from stakeholders.

The Formal Syllabi Note, Deliverable 6, is a very important document. As mentioned previously, these documents comprise all the course syllabi our team were given to analyze along with our notes and suggestions to improve them. Our team incorporated specific instructions on how to improve course outcomes to better fit each course, along with providing our team's mapping of the CO and SO alignment. For issues where the COs were vague and unclear, we suggested new COs that were reworded to better encompass the focus of the course and its outcomes. Our team created a separate document for each program that we evaluated to assist in the improvement of COs.

Our team also created program-specific reports in addition to this final report. The purpose of these was to give each program a more in-depth look at all our findings and recommendations. We also compiled all of our analyzed data to hand over to the departments as well as the raw data if they would like to analyze it in the future. This should give each program a look at all the specific findings that are unique to their program along with all of the data and evidence we found to back them up. We will also include all of the distinct areas of improvement and suggestions on how to better them. Our hope is that all of the findings and recommendations in these reports will be taken into consideration and addressed before an ABET evaluation team is brought in, so the programs are best prepared for an assessment.

Appendix A. Program Student Outcomes

	Engineering Program	Computing Program
ABET Student Outcome #1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	An ability to analyze a complex computing program and apply principles of computing and other relevant disciplines to identify solutions.
ABET Student Outcome #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.	An ability to design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
ABET Student Outcome #3	An ability to communicate effectively with a range of audiences.	An ability to communicate effectively in a variety of professional contexts.
ABET Student Outcome #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 a global, economic, environmental, and societal contexts.	An ability to recognize professional responsibilities and make informed judgements in computing practice based on legal and ethical principles.
ABET Student Outcome #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.	An ability to function effectively as a member of a team engaged in activities appropriate to the program's discipline.
ABET Student Outcome #6	An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.	An ability to apply computer science theory and software development fundamentals to produce computing-based solutions.
ABET Student Outcome #7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	

Appendix B. Interview Questions

Appendix B.1 Statement of Consent

We are asking you to participate in a research study titled "Evaluating Program Compliance with ABET Standards within the College of Engineering at UIR". We will describe the study to you and answer any of your questions. The study is being led by Katie Houskeeper, Morgan Hughes, and Mary (Addie) Suckow, for a student project at Worcester Polytechnic Institute. The faculty advisors for this study are Mohammed El Hamzaoui and Joseph Doiron at Worcester Polytechnic Institute. The purpose of this research is to learn about your experience at UIR in your chosen program and how this may impact the post-graduate experience.

We ask you to participate in an interview that asks you about your experiences at UIR. This interview will last approximately 30 minutes. We do not anticipate any risks from participating in this research. Information gained from this study may lead to ABET Accreditation in Computer Science, Aerospace Engineering, Automotive Engineering or Renewable Energy Programs at the International University of Rabat. We hope to learn your perspectives of your program to understand the relationship between postgraduate experience and student outcomes.

There will be no compensation or credit given for this study. Your privacy and confidentiality will be protected. Your involvement is voluntary. You may refuse to participate before the interview begins, discontinue at any time, and skip any questions you are not comfortable answering.

The main researchers conducting this study are Katie Houskeeper, Morgan Hughes, and Mary (Addie) Suckow, undergraduate students at Worcester Polytechnic Institute. Please ask any questions you have before the interview begins. Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you. You may decide to stop participating in the research at any time without penalty.

For more information about this research or about your rights as a research participant, may contact us at gr-UIR-ABET-D22@wpi.edu or at +1 (518) 772-9746, the IRB Manager (Ruth McKeogh, Tel. +1 (508) 831-6699, Email: irb@wpi.edu), or the Human Protection Administrator (Gabriel Johnson, Tel, +1 (508) 831-4989, Email: gjohnson@wpi.edu).

Appendix B.2 Student Interview Questions

Opening Questions

1. Why did you choose to attend UIR and participate in the Energy program
2. Would you make the same decision again?
3. On average, what grade do you usually receive in your courses?

Program Questions

1. What are some strengths and weaknesses in the Energy Program?
2. What's one thing you would change about the program if you could?

Faculty

1. How do you characterize your typical professor?
2. Do you feel supported by your faculty?
3. Are they approachable inside and outside the classroom?
4. Do you feel that your faculty are qualified to be teaching the material?
5. How do they usually teach (lecture, group projects, examples, etc.)?

Labs

1. Do you get a lot of hands-on experience in the lab?
2. In general, are you able to apply what you learn in the classroom when working in the lab?

Program Preparedness

1. What are your plans for post-graduation?
2. Do you feel like you're being prepared for working in the industry?

Communication

1. Do you regularly give oral presentations in classes?
2. Do you feel like you can effectively communicate in a professional setting?

Teamwork

1. Do you regularly work on projects in a group?
2. Do you wish you had more group projects?

Closing Questions

1. Do you have anything else you would like to share with our team?
2. Do you have any suggestions for our team on how to better conduct these interviews?
3. Do you have any questions for our team?

Appendix B.3 Faculty Interview Questions

Opening Questions

1. What courses do you teach within that program?
2. Are you a full-time or part-time teacher at UIR?
3. How many courses do you teach on average each semester?
4. How long have you been working at UIR?
5. On average, what grade does the average student earn in most of your courses?
6. Have you worked at any other universities? If so, please compare your experience as a faculty member at UIR with those previous institutions.

Program Questions

1. What are some strengths and weaknesses in the Energy Program?
2. Do you feel the amount of faculty in your program can support the number of students?
3. Do you feel supported by university staff and administration?
4. Do you think students feel supported by administration?
5. Do you feel supported by direct supervisor(s)?
6. Do you feel supported by colleagues?
7. What is frustrating about serving as a faculty member at UIR?

Course Questions

1. What is your typical teaching style?
2. Are there lots of research opportunities?
3. Do any of the courses you teach require students to use equipment/machinery such as those within the Technical Hall?
    0. If yes, are necessary materials provided to them? Or do they need to buy them on their own?
4. How would you describe the physical facilities (classrooms, offices, laboratories, etc.) that serve your program.
5. How often are students collaborating with one another inside your classroom or during your course?

ABET/ Accreditation Specific Questions

1. What are your thoughts on the College of Engineering pursuing an ABET accreditation?
2. Are you at all involved in the current efforts for accreditation at UIR?
3. Do you understand the benefits of ABET accreditation?
4. Please describe program outcomes and student outcomes outlined by ABET to the best of your knowledge.
5. Have you attended workshops or similar events to learn how to facilitate courses and evaluate them in alignment with accreditation standards (building syllabi, course assessments, etc.)?
6. In terms of course planning, how do you create course outcomes?
7. Do you feel they align with student outcomes expected in the program?
8. Are you familiar with what IRE stands for?
    a. If yes, please explain.

Appendix B.4 Alumni Interview Questions

Demographics

1. What year did you graduate from UIR?
2. What program did you study in while you were a student?
3. Are you currently pursuing higher education or are you working in your chosen industry?

General Questions

1. During your time at UIR, did you see noticeable and purposeful improvements throughout the years? What did some of those improvements look like?
2. Why did you choose the program you did to study at UIR? Would you make the same decision again?

Faculty

1. Did you feel like the faculty and administration at UIR were actively seeking to make the institution better?
1. Did you interact with your faculty? If so: How did you interact? Was there student advising and counseling options?
2. Did faculty provide a good balance between theory and practice?

Industry Preparation

1. Did you have opportunities to interact with industrial and professional practitioners? With employers?
2. Did UIR have any involvement in your post-graduate career options or internships you had while in the program?
3. Did you use tools, software, and other equipment in labs? If so, did you have appropriate guidance and learn how to safely use the equipment?
4. How did your experiences learning how to use lab equipment impact your ability to be successful in the workforce?
1. Are there certain types of equipment you wish you had been trained how to use while at UIR that would have benefited you today?

Curriculum

1. Did the courses you took adequately prepare you to enter the workforce after graduation?
2. Did academic support services (academic advising, computer center, library facilities, etc.) meet your needs while you were a student at UIR?
3. Were you given the opportunity to talk to potential employers while you were a student?
4. How did you meet your current employer?

Closing Questions

1. Would you recommend UIR to young adults seeking a degree in your field?
2. What changes would you make to your program at UIR if you could?
3. What single message, if any, would you like the team to convey to the Dean, Program Administrator, or President of the University?
4. Do you have anything else you would like to share with our team?
5. Do you have any questions for our team?

Appendix B.5 Employer Interview Questions

Demographics

1. What company do you work for?
2. What is your job title? Have you hired any students from UIR's College of Engineering programs for full time positions?
3. Do you hire UIR students for internships while they are working towards their degree?

General Questions

1. What is your perception of UIR? What do you feel is the reputation of UIR in the broader community?
2. Are there certain universities you prefer to hire students from?
3. What qualities, including soft skills, do you look for in candidates?
4. What technical skills do you require or prefer a candidate has?
5. Do you prefer applicants with teamwork and project-based learning experience?
6. Do you prefer that the graduates you hire obtained their degree from an accredited program?
7. What are some strengths and weaknesses of the employees from UIR that work at your company?

Closing Questions

1. Would you continue to hire students or graduates from UIR's programs?
2. What is one piece of advice you would give UIR administration to better prepare students for industry?
3. Do you have anything else you would like to share with our team?
4. Do you have any questions for our team?

Appendix C. Project Deliverables

Deliverable 1: Outcome Mapping Matrix Tool

Our team created a template for the Outcome Mapping Matrix we used to complete the Objective 1. This tool can be used for future syllabus evaluation. Once downloaded, the user can follow the User Guide included to correctly map course and student outcomes and analyze other contents of the course syllabus.
Outcome Mapping Matrix

Deliverable 2: IRE Verb List

INTRODUCE		REINFORCE		EMPHASIZE	
Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Cite	Add	Acquire	Analyze	Appraise	Abstract
Define	Approximate	Adapt	Audit	Assess	Animate
Describe	Articulate	Allocate	Blueprint	Compare	Arrange
Draw	Associate	Alphabetize	Breadboard	Conclude	Assemble
Enumerate	Characterize	Apply	Break down	Contrast	Budget
Identify	Clarify	Ascertain	Characterize	Counsel	Categorize
Index	Classify	Assign	Classify	Criticize	Code
Indicate	Compare	Attain	Compare	Critique	Combine
Label	Compute	Avoid	Confirm	Defend	Compile
List	Contrast	Back up	Contrast	Determine	Compose
Match	Convert	Calculate	Correlate	Discriminate	Construct
Meet	Defend	Capture	Detect	Estimate	Cope
Name	Describe	Change	Diagnose	Evaluate	Correspond
Outline	Detail	Classify	Diagram	Explain	Create
Point	Differentiate	Complete	Differentiate	Grade	Cultivate
Quote	Discuss	Compute	Discriminate	Hire	Debug
Read	Distinguish	Construct	Dissect	Interpret	Depict
Recall	Elaborate	Customize	Distinguish	Judge	Design
Recite	Estimate	Demonstrate	Document	Justify	Develop
Recognize	Example	Depreciate	Ensure	Measure	Devise
Record	Express	Derive	Examine	Predict	Dictate
Repeat	Extend	Determine	Explain	Prescribe	Enhance

Review	Extrapolate	Diminish	Explore	Rank	Explain
Select	Factor	Discover	Figure Out	Rate	Facilitate
State	Generalize	Draw	File	Recommend	Format
Study	Give	Employ	Group	Release	Formulate
Tabulate	Infer	Examine	Identify	Select	Generalize
Trace	Interact	Exercise	Illustrate	Summarize	Generate
Write	Interpolate	Explore	Infer	Support	Handle
	Interpret	Expose	Interrupt	Test	Import
	Observe	Express	Inventory	Validate	Improve
	Paraphrase	Factor	Investigate	Verify	Incorporate
	Picture Graphically	Figure	Layout		Integrate
	Predict	Graph	Manage		Interface
	Review	Handle	Maximize		Join
	Rewrite	Illustrate	Minimize		Lecture
	Subtract	Interconvert	Optimize		Model
	Summarize	Investigate	Order		Modify
	Translate	Manipulate	Outline		Network
	Visualize	Modify	Point out		Organize
		Operate	Prioritize		Outline
		Personalize	Proofread		Overhaul
		Plot	Query		Plan
		Practice	Relate		Portray
		Predict	Select		Prepare
		Prepare	Separate		Prescribe
		Price	Subdivide		Produce
		Process	Train		Program

		Produce	Transform		Rearrange
		Project			Reconstruct
		Provide			Relate
		Relate			Reorganize
		Round off			Revise
		Sequence			Rewrite
		Show			Specify
		Simulate			Summarize
		Sketch			
		Solve			
		Subscribe			
		Tabulate			
		Transcribe			
		Translate			
		Use			

Deliverable 3: Inter-Rater Reliability Calculating Tool

As mentioned in the Methodology Chapter, Inter-Rater Reliability (IRR) can be used to ensure consistency between three or more raters. We created this IRR Calculating Tool so that the score can be calculated when multiple people are mapping a course's outcomes to the ABET student outcomes. The tool can be used for syllabi with two to five Course Outcomes. A "0" represents a disagreement between a pair of raters while a "1" denotes an agreement.

Inter-Rater Reliability Calculating Tool

Deliverable 4: Thematic Coding Templates

Below, our team has included the thematic coding templates used to analyze interviews with students, alumni, and faculty. Coding each interview allows for an easy analysis and comparison of stakeholder's perspectives and experiences and can be used to help identify themes.

Student Interview Coding Template

Topic	Questions	Codes	Examples
Opening Questions	**Why UIR?**	Referred	Family/ Parents
			Family Friend/ Friend
			Alumni
			Random
		Academics	Teaching Language
			Major
		Proximity	
		Status	
		Other	Other
	Why Program?	Passion	
		Uncommon Major	Uncommon
		Opportunities	Job Opportunities
			Interdisciplinary Learning
			Learning Opportunities

	Would you make the same decision again?	Yes	
		No	
		Other	
	Average Grade	Add Manually	
Program Questions	**Strengths**	Faculty	
		Interdisciplinary Learning	
		Teaching Language	
		Job Opportunities	
		Project Work	
	Weaknesses	Workload	Hours
			Student Expectations
			Difficulty of Material
			Evaluation Methods
		Faculty	
		Interdisciplinary Learning	
		Teaching Styles	
		Theory and Practice	Equipment
			Labs

		Lack of Specialties	
	What would you change?	Workload	
		Faculty	
		Interdisciplinary Learning	
		Teaching Styles	
		Theory and Practice	
		Labs	
		Quality of Materials	
		Group/Team Learning	
		Job Opportunities	
		Student Support	
		Continuity of Industry and Academics	
Faculty?	**Characterize your typical professor.**	Positive	Approachable
			Accommodating
			Understanding
		Negative	Unapproachable
			Rude
		Neutral	

	Do you feel supported?	Yes
		No
	Are they approachable (Inside and outside the classroom)?	Yes - Both
		No - Only Inside
		No - Only Outside
		No
	Are they qualified?	Yes
		No
		Sometimes
	How do they teach?	Lecture-heavy
		Group Work
		Examples
		Labs/Hands-On
		Independent Learning
		Written/ Oral Presentations
Labs	**Do you have a similar relationship with staff and administration?**	Yes - Same
		No - Worse
		No - Better

	Describe it.	Positive	Approachable
			Accommodating
			Understanding
		Negative	Unsupportive
			Not helpful
		Neutral	
	Enough hands-on experience?	Yes	
		No	
		Neutral	
	Good balance of theory and practice?	Yes	
		No	
	Enough equipment?	Yes	
		No	
	Equipment Quality	Good	
		Poor	
Industry Preparedness	**Post-grad plans?**	Furthering Education Locally	
		Furthering Education Abroad	
		Industry Locally	

		Industry Abroad
		Gap Year
	Are you prepared for them?	Yes
		No
	Are you prepared to do them internationally?	Yes
		No
	Do employers or industry professionals come to school?	Yes
		No
	Does UIR help find jobs for students?	Yes
		No
		Clubs
SO3	**Amount of oral presentations?**	Large Amount
		Fair/Normal Amount
		Lacking
	Do students do well with oral presentations?	Yes
		No
		Sometimes
	Professional Communication	Yes

		No
		Sometimes
SO5 **Misc.**	**Do you do group work often?**	Often
		Fair/Normal Amount
		Lacking
	Do you get to play different roles on a team?	Yes
		No
		Sometimes

Faculty Interview Coding Template

Topic	Questions	Codes	Examples
Opening Questions	**Full Time or part-time?**	Full-Time	
		Part-Time	
	# of courses taught per semester	Add Manually	
	How long have you worked at UIR?	Add Manually	
	Have you worked at any other universities?	Yes	
		No	
	Please compare your experiences teaching at other universities	Positive	Very similar to UIR
			Administration are more available
			Advising for students

			Research publications more encouraged at UIR
		Negative	Students are less serious at UIR
		Other	Tougher curriculum elsewhere
Program Questions	**Strengths**	Theory and Practice	Labs
		E-Learning	
		International Opportunities	
		Holistic Education (Soft skills, technical skills, languages)	
	Weaknesses	Project Work	
		Hands-On Experience	
		Workload	Course load
			Exam Preparation Time
			Hours
	Does the amount of faculty support amount of students?	Yes	
		No	
	Do you feel supported by staff and administration?	Yes	Quick responses
		No	Ignore Communication
			Low Number of Administration
	Do you think students are supported by administration?	Yes	Advising Committees
		No	Other

	Do you feel supported by your direct supervisor?	Yes	
		No	
		N/A	No Supervisor
	Do you feel supported by your colleagues	Yes	Strong Dynamic
		No	Competition
	Is there anything frustrating about serving as a faculty member?	Poor Quality ABET Workshops	
		COVID-19's Impact	
		Other	
		Workload	Required Teaching Hours
			Expected Services
	What is the biggest obstacle keeping the Program from attaining accreditation?	Faculty	Reluctance
			Portfolio Assembly
			Part-Time
		Difficulty	French Style System
			Time Requirement
Course Questions	**Typical teaching style**	Lecture-based	
		Quizzes	
		Student Collaboration	Group Projects
			In-Class Exercises
		Exams	

		In-Class Examples	
		Labs	
		Videos	
		Research	
	Do your courses require students to use equipment in the Technical Hall?	Yes	
		No	
	Are the necessary materials provided for them?	Yes	Desktops w/ Software
			Instruction Manuals
		No	Other
	Are there research opportunities?	Yes	Government Funded
			Company Involvement
		No	Other
	How would you describe the physical facilities?	Positive	Responsive IT
			Up to Date Labs
		Negative	Out of Date Technology
			Small Classrooms
			Old Furniture / Equipment
			Maintenance During Class Time
	What changes would you recommend to the curricula?	Quantity of E-Learning	
		Adjunct Professors	

		Industry Preparation	
ABET Specific Questions	**What are your thoughts on pursuing ABET accreditation?**	Positive	Benefits
		Negative	Difficult
			Increased Workload
	Are you involved in the accreditation effort?	Yes	
		No	
	Do you understand the benefits of ABET accreditation?	Yes	Improve Courses
			International Opportunities
			Students
			Faculty
		No	
		Minimally	
	Describe Program Outcomes and Student Outcomes	Good Understanding	
		Don’t Understand	
	Have you attended workshops/ events to learn how to align courses with ABET?	Yes	United States
			Video Tutorial
			Verb Usage Instruction
		No	
		No Assistance	

	How do you create course outcomes?	Based on the Course	
		Textbook Based Outcomes	
	Are you familiar with what IRE stands for?	Yes	
		Partially	Understand Concept
			Recognize Name
		No	

Deliverable 5: Program Specific Reports

Our team created three program-specific reports to outline any findings or recommendations that were not found as a general finding across every program. These were provided to the Aerospace & Automotive Engineering, Energy Engineering, and Computer Science programs. These documents offer a more in-depth look at what our team analyzed and found throughout our project, as this report only includes general findings.

Aerospace & Automotive Engineering Program-Specific Report

Computer Science Program-Specific Report

Energy Engineering Program-Specific Report

Deliverable 6: Formal Syllabi Notes

Aerospace & Automotive Engineering Syllabi Notes

Our team has created a single figure for each course syllabi that was provided to our team by the College of Engineering's Aerospace Engineering and Automotive Engineering programs. Each figure includes the following:

- Course name
- The year and semester the course is offered
- A correctly mapped Outcome Matrix
- The verbs present within the instructor created course outcomes
- A notes section that describes any additional recommendations our team has for syllabi improvement

Additionally, figures have been arranged by the academic year the student takes the course to aid in report organization and user experience.

Once these recommendations are implemented, the Aerospace Engineering and Automotive Engineering programs will see noticeable progress toward better alignment of its program syllabi to ABET Accreditation standards.

YEAR 1

COURSE NAME: American Civilization (INTA1200)

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1		I					I
CO2		I	I				I
CO3		I	I				I
CO4		I	I				
CO5			I				
CO6			I				
CO7						I/R	I/R
CO8			I	I			
CO9			I			I	I
CO10							I

Verbs used in Syllabus: Identify, Discuss, Name, Summarize, Explain, Express, Understand

NOTES:

- Where judgment was used to compare/contrast, we said it aligned with SO6
- Sections of the syllabus are missing (credit hours)
- Too many Course Outcomes
- Some COs can be combined to reduce the total amount - ex:
    - CO1 & CO2 could be combined to read "**Identify** some of the founding ideas of the United States of America and **discuss** the origins of these ideas"
    - CO5 & CO6 could be combined to read "**Explain** the origins of the Civil War and **discuss** some of the outcomes"

COURSE NAME: Calculus I

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	E						E
CO2	R					R	R
CO3	I						I
CO4	R						R
CO5	R						R
CO6	R						R
CO7	R						R
CO8	R						R

Verbs used in Syllabus: Evaluate, Calculate, Interpret, Solve, Apply, Use

NOTES:

- Course Outcomes that introduce *and* reinforce topics need to use verbs from both the I and R level
- Sections of the syllabus are missing (credit hours, topical outline chart is not filled in)
- Good use of the IRE verbs in each Course Outcome

COURSE NAME: Calculus II

COURSE YEAR/SEMESTER: Year 1, Semester 2

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	R/E						R/E
CO3	R						R
CO4	R/E						R/E
CO5	I/R						I/R
CO6	R/E						R/E

Verbs used in Syllabus: Evaluate, Use, Apply, Determine, Calculate

NOTES:

- The phrase "Deal with" should be removed from Course Outcome 6 and replaced with an IRE verb (such as "Examine," "Identify," or "Interpret" depending on what the professor's goal is)
- Sections of the syllabus are missing (lecture topical outline chart is not filled in, grading breakdown incomplete)

COURSE NAME: Civilization Francais

COURSE YEAR/SEMESTER: Year -, Semester -

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1							
CO2							
CO3							
CO4							
CO5							
CO6							

Verbs used in Syllabus:

NOTES:

- Syllabus did not list any Course Outcomes so it could not be mapped - needs to develop Course Outcomes

COURSE NAME: Computer Programming

COURSE YEAR/SEMESTER: Year -, Semester -

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E	R/E					R/E
CO2	I					I	I
CO3	E	E					E

Verbs used in Syllabus: Design, Solve, Understand, Develop

NOTES:

- CO2's wording is fairly vague, could be made more specific
- If CO3 includes teamwork, that should be explicitly expressed in the Course Outcome verbiage
    - Ex: "**Develop** C programs and projects in groups and **demonstrate** the ability to work on a team"

COURSE NAME: Fundamentals of Chemistry I

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I/R						I/R
CO2	R						
CO3	I/R						I/R
CO4	I/R						I/R
CO5	I/R						I/R
CO6	R		R				R
CO7	I/R		I/R				I/R
CO8	I/R		I/R				I/R
CO9	I		I				I
CO10			I/R				I/R
CO11	I/R		I/R				I/R
CO12	R					R	R
CO13	I/R/E		I/R/E			I/R/E	I/R/E

Verbs used in Syllabus: Understand, Use, Explain, Apply, Write, Predict, Describe, Illustrate, Compare, Discuss, Operate, Plan, Execute, Evaluate

NOTES:

- Remove the verb "Perform" in CO1 - replace it with an IRE verb such as "Solve" or "Calculate" (ex. "**Solve** problems based on stoichiometric relationships)
- Remove the verbiage "Demonstrate knowledge of" in CO12 - replace it with an IRE verb such as "Practice" or "Demonstrate" (ex. "**Practice** basic laboratory skills")

- Course Outcomes need to reflect the lab component as shown on the syllabus - then COs can be mapped to SO6
- Too many Course Outcomes
- If a lab is team-based, the COs need to reflect that and can then be mapped to SO5

COURSE NAME: Fundamentals of Chemistry II

COURSE YEAR/SEMESTER: Year 1, Semester 2

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I/R		I/R				I/R
CO2	I/R/E						I/R/E
CO3	I		I				I
CO4	I/R						I/R
CO5	I/R						I/R
CO6	R					R	R
CO7	R						R
CO8	I/R		I/R				I/R

Verbs used in Syllabus: Describe, Calculate, Write, Relate, Articulate, Identify, Predict, Determine, Analyze, Perform, Apply, Discuss

NOTES:

- Too many Course Outcomes
- If a Course Outcome includes a team-based or group project, the CO should reflect that, therefore the CO would align with SO5
- Course description on the syllabus is a list of topics, needs to be written out in paragraph form
- Too many Course Goals on syllabus

COURSE NAME: English Composition I

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1			I				I
CO2		E	E				E
CO3			R/E				R/E
CO4			R				
CO5			R				
CO6			R/E				R/E
CO7			I				I
CO8		E	E	E			E
CO9							E

Verbs used in Syllabus: Understand, Generate, Use, Describe, Develop, Support

NOTES:

- Too many Course Outcomes
- Remove the verbiage "Demonstrate an understanding of" in CO1 - replace with "Understand" (ex. "**Understand** the basic structure and organization of a paragraph")
- Remove the verbiage "Make use of" in CO3 - replace with "Use" (ex. "**Use** varied sentence structures in developed writing")

COURSE NAME: English Composition II

COURSE YEAR/SEMESTER: Year 1, Semester 2

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1			I				I
CO2			E				E
CO3			E				E
CO4			I				
CO5			E				E
CO6			R/E				R/E
CO7		R/E		R/E			R/E
CO8							R/E

Verbs used in Syllabus: Understand, Develop, Analyze, Evaluate, Find, Integrate, Document

NOTES:

- Too many Course Outcomes
- Course Description on the syllabus is the same as English Composition I, it needs to be rewritten so it is unique to English Composition II
- If English Composition I is a prerequisite of English Composition II the syllabus should reflect that
- Some Course Outcomes are very similar to those of English Composition I (CO1 and CO2) - if they are a Course Outcome of English Composition I it should not be one for English Comp II
- Assignments within the grading breakdown need to be specified
- Remove the verbiage "Demonstrate an understanding of" in CO1 & CO4 - replace with "Understand" (ex. "**Understand** the basic structure and organization of a paragraph and an essay")
- Remove the verbiage "Demonstrate the ability to" in CO2, CO3, CO5, CO6, CO7, CO8 - replace with:
    - CO2: "**Develop** correct sentences varied in type and complexity"
    - CO3: "**Develop** long coherently and cohesively connected stretches of text"
    - CO5: "**Develop** a five-paragraph essay"
    - CO6: "**Develop** an individual style of thinking and writing to demonstrate critical analysis and effectively communicate original ideas in written discourse"
    - CO7: "**Analyze** and **evaluate** different forms of existing literature in order to further **examine** human experiences and **relate** these to global issues"

    - CO8: "**Find**, **evaluate**, **integrate** and properly **document** information from libraries, the Internet, and other sources, with an eye for reliability, bias, and relevance"
- CO6 is an assignment and could be removed from the Course Outcomes and added as a course assignment on the syllabus

---

COURSE NAME: Ethics

COURSE YEAR/SEMESTER: Year 1, Semester 2

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1					I		
CO2				I	I		I
CO3					R		R
CO4				R	R		R

Verbs used in Syllabus: Understand, Articulate, Analyze

NOTES:

- If there are team-based or group projects within the course, the Course Outcomes should reflect that, therefore they would align with SO5
- CO4, "Present" isn't an IRE verb, should be rewritten as "**Summarize** research work on an ethical question in an oral presentation"

COURSE NAME: Freshman Seminar

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1			R				R
CO2							I
CO3			I				I
CO4			*				
CO5			*				
CO6			*				
CO7			*				
CO8			*				
CO9			*				*

Verbs used in Syllabus: Use, Write, Discuss, Listen

NOTES:

- Too many Course Outcomes
- CO4-CO9 do not use IRE level verbs so they cannot be mapped to an IRE level, they are only mapped to the Student Outcome they align with (using asterisks instead of I, R, E) - can be replaced with:
    - CO4: "**Understand** the specific jargon of the aero-auto field"
    - CO5 can be combined with CO6 and CO7 - ex. "**Identify** main ideas, supporting details, and numerical information when listening to a conversation"
    - CO8 - should be removed, that is a classroom expectation not a Course Outcome
    - CO9: "**Create** and present effective public presentations"

COURSE NAME: Introduction to Computer Science

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I/R						I/R
CO2	R/E						R/E
CO3						E	E
CO4	I/R						I/R
CO5	R						I/R
CO6	I/R						R
CO7	R						R
CO8	R						R
CO9	R						R
CO10	R						R

Verbs used in Syllabus: Translate, Solve, Code, Organize, Use, Draw

NOTES:

- Too many Course Outcomes
- Remove "The student must" from Course Outcomes
- Course Outcomes need to be made more specific and clear - ex:
  - Replace CO2 with "**Code** algorithms efficiently using MATLAB language"
  - Replace CO3 with "**Organize** date in MATLAB (variables, vectors, matrices, etc.)
  - Replace CO4 with "**Define** and **use** functions"
  - Replace CO5 with "**Use** each kind of loop (specify what the kinds of loops are they are expected to use)"
  - Replace CO6 with "Draw 2D and 3D shapes in MATLAB"
  - Combine CO7 and CO9: "**Use** built-in MATLAB functions to **demonstrate** image processing and **solve** linear and nonlinear functions"
  - Replace CO8 with "**Manipulate** vectors and ___ them in a specific format"
  - Replace CO10 with: "**Use** Euler's method to **solve** first and second order ODE problems"
- Add a textbook to the syllabus if applicable

COURSE NAME: Fundamentals of Physics I

COURSE YEAR/SEMESTER: Year 1, Semester 2

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E	R/E				R/E	R/E
CO2	*		*			*	
CO3	R						R
CO4	I						I
CO5			I/R				
CO6	R					R	R
CO7	I/R						I/R

Verbs used in Syllabus: Design, Collect, Write, Use, Convert, Describe, Analyze, Predict, Recognize

NOTES:

- CO2 does not use IRE level verbs so it cannot be mapped to an IRE level, needs to be rewritten to include a correct verb (ex. "**Explain** verbally and in writing the purpose, design, and results of an experiment")
- Syllabus says that a prerequisite for Physics I is Physics I which is not possible, put N/A for prerequisites if there are none
- Lab exercises and assignments need to be listed on the syllabus
- Any Course Outcomes that include a lab component need to include that in their verbiage and mapped to SO6
    - If the lab exercises are team-based the COs should reflect that and therefore they can be mapped to SO5

COURSE NAME: Wellness

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1			I				I
CO2				I			
CO3							
CO4	E						E
CO5							R

Verbs used in Syllabus: Define, Discuss, Identify, Create, Apply

NOTES:

- CO3 does not align with any Student Outcomes, but it could be combined with another Course Outcome so that it aligns
    - Ex. Combine CO2, CO3, and CO4: "**Identify** where you are in life, **create** a life vision and an action plan and **implement** the plan"
- Credit hours need to be added to the syllabus

YEAR 2

COURSE NAME: Calculus III

COURSE YEAR/SEMESTER: Year 2, Semester -

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R						R
CO3	R						R
CO4	R						R
CO5	R						R

Verbs used in Syllabus: Use, Analyze

NOTES:

- Remove "Demonstrate mastery of" in CO3 & CO5
  - Replace CO3 with "Understand concepts and computations of vectors and vector-valued functions"
- Remove "Demonstrate the ability to" in CO1, CO2, and CO4
  - Replace CO1 with "Use Mathematica for calculations and graphics associated with parameterized curves in the plane and in space
  - Replace CO2 with "Use polar coordinates in the plane"
  - Replace CO4 with "Analyze parameterized curves and motion in space"
- Mapping done on syllabus claims COs are E level, but they need E level verbs in the description for that to be correct

COURSE NAME: Calculus IV

COURSE YEAR/SEMESTER: Year 2, Semester 4

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I/R						I/R
CO3	R						R
CO4	R/E						R/E
CO5	R						R

Verbs used in Syllabus: Recognize, Compute, Integrate, Use

NOTES:

- Spelling of Course Outcomes is poor and needs to be improved
- Remove “Dominate concepts of” in CO5 - replace with IRE verbs such as “Understand”
- Sections of the syllabus are missing (credit hours and course catalog description)

COURSE NAME: Differential Equation

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	E						E
CO2	R/E						R/E
CO3	I/R						I/R
CO4	I/R/E						I/R/E
CO5	R						R
CO6	R						R
CO7	I/R						I/R

Verbs used in Syllabus: Model, Test, Visualize, Use, Approximate, Understand, Solve

NOTES:

- Course is considered “Math 3” but has no prerequisites - need to be added if applicable
- Syllabus is missing credit hours

COURSE NAME: Digital Electronics

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E					R/E	R/E
CO2	I/E						I/E
CO3	I/E						I/E
CO4	*				*	*	*
CO5	E					E	E
CO6	R/E					R/E	R/E
CO7	R/E						R/E
CO8	R						R
CO9					*	*	
CO10	E	E					E

Verbs used in Syllabus: Analyze, Design, Use, Understand, Apply, Identify, Formulate, Solve

NOTES:

- CO2 & CO3 should be combined - "Understand and design combinational and sequential logic circuits"
- CO4 & CO9 do not use IRE verbs so they cannot be mapped to an IRE level, asterisks are used instead to show their alignment with Student Outcomes
    - CO4 - use "**Demonstrate** the ability to effectively work on a team through digital circuit experiments and projects"
- CO9 should be removed as it is the same as CO4
- CO10 is not complete, needs to be finished

COURSE NAME: Engineering Mechanics I

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R						
CO3	R						R
CO4	R/E						R/E
CO5	R/E						R/E
CO6	R/E						R/E

Verbs used in Syllabus: Apply, Use, Determine, Design

NOTES:

- Remove “Demonstrate the ability to” from CO4 - “Determine a statically indeterminate problem and superposition principle”
- CO2 could be expanded on so it is not so vague
- Syllabus needs credit hours and assignments if applicable

COURSE NAME: Engineering Mechanics II

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R						R
CO3	R						R
CO4	R						R
CO5	R						R
CO6	R						R
CO7	R						R
CO8	R						R

Verbs used in Syllabus: Solve

NOTES:

- Syllabus says this course is taken in the Fall semester, is that correct? That would mean that Engineering Mechanics I and Engineering Mechanics II are taken at the same time
- Some Course Outcomes could be combined, ex:
    - CO2 & CO3: “Solve problems of kinematics involving rectilinear and curvilinear motion of particles”
    - CO4, CO5, CO6, CO7: “Solve problems of kinetics involving Newton’s second law, angular momentum and torques, Energy method, and impulse and momentum method”

COURSE NAME: Industrial Management

COURSE YEAR/SEMESTER: Year -, Semester -

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1							
CO2							
CO3							
CO4							
CO5							
CO6							
CO7							
CO8							

Verbs used in Syllabus:

NOTES:

- Syllabus is confusing and does not explicitly outline the Course Outcomes so it was not able to be mapped according to alignment with ABET Student Outcomes

COURSE NAME: Introduction to Linear Algebra

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R		R				R
CO2	*						*
CO3	R/E						R/E
CO4	I/R						I/R
CO5	I/R						I/R
CO6	I/R						I/R
CO7	I/R				I/R		I/R
CO8	R						R
CO9	I						I
CO10	*						*
CO11	R						R
CO12	*						*
CO13	*						*
CO14	*						*
CO15	I/R						I/R

Verbs used in Syllabus: Solve, Use, Describe, Characterize, Determine, Compute, Understand, Manipulate, Realize, Represent, Link

NOTES:

- Structure of Course Outcomes on the syllabus is confusing (there are two different groups of outcomes, it should be made more clear what the outcomes are)
- CO1 is too long, should be split up (ex. "**Interpret** a linear system as a matrix equation, **solve** the system using Gauss method, then **describe** the solution as a set of a homogeneous equation"
- Remove "Demonstrate mastery of" from CO2 - replace it with "**Understand** concepts of linear combinations of vectors in Rn…"
- Remove "Demonstrate understanding of" from CO5 and CO6, replace with "**Understand**"
- CO10, CO12, CO13, and CO14 do not use IRE verbs so they cannot be mapped to an IRE level, asterisks are used in place of I, R, E to show their alignment with Student Outcomes - need to be rewritten to include correct IRE verbs, ex:
    - CO10: "Identify a computation and linear combination of a vector"
    - CO12: "Characterize any linear map in different bases"
    - CO13: "Relate linear maps and matrices"
    - CO14: "Relate matrices and linear systems and perform computation on matrices"
- Sections of the syllabus are missing or incorrect (credit hours, grading breakdown)

COURSE NAME: LV1

COURSE YEAR/SEMESTER: Year 2, Semester 4

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1			R				R
CO2			E				E
CO3			R				R
CO4			I		I		I
CO5			E				E
CO6			R/E				R/E
CO7			R	R	R		R

Verbs used in Syllabus: Discover, Improve, Relate, Acquire, Understand, Develop, Solve

NOTES:

- Sections of the syllabus are missing (credit hours, course ID)
- Course description could be expanded upon to give a more holistic overview of the course
- Assignments on the syllabus need to be better organized
    - Need to clarify if assignments are graded or not
- Lab exercises on the syllabus should be moved to assignments because they do not fall under the lab exercise category

COURSE NAME: Engineering Drawing II: Modeling and Manufacturing

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	R						R
CO3	I						
CO4	I						
CO5	E					E	E

Verbs used in Syllabus: Create, Solve, Understand, Design

NOTES:

- Clarify if CO1 includes teamwork, if so it needs to be explained in the Course Outcome, therefore it can be mapped to SO5
- CO4 is lacking in proper grammar, needs to be rewritten for clarity
- If using machinery in CO4 is in a lab setting it should include verbiage to reflect that and therefore can be mapped to SO6
- Topical Outline on syllabus is done very well and can be used as an example
- Syllabus needs to clearly show where assignments fall in the grading rubric

COURSE NAME: Physics II

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	R						R
CO3	I						I
CO4	I						I
CO5	R						R
CO6	I/R		I/R			I/R	I/R

Verbs used in Syllabus: Understand, Solve, Apply

NOTES:

- CO6 needs an IRE verb that shows that the experiment is being done, (ex. "**Understand** and **Perform** lab experiments, and **write** lab reports")
- If the lab experiments in CO6 are team-based the Course Outcomes should reflect that, therefore they can align with SO5
- Calculus is listed as a prerequisite on the syllabus, need to specify which level(s) of Calculus

COURSE NAME: Physics III

COURSE YEAR/SEMESTER: Year 2, Semester 4

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	R						R
CO3	I						I
CO4	I						I
CO5	I						I
CO6	I						I
CO7	I		I			I	I

Verbs used in Syllabus: Understand, Apply

NOTES:

- CO7 needs an IRE verb that shows that the experiment is being done, (ex. "**Understand** and **Perform** lab experiments, and **write** lab reports")
- If lab experiments in CO7 are team-based the Course Outcomes should reflect that, therefore they can align with SO5

COURSE NAME: Thermodynamics I

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	*						*
CO2	*						*
CO3	R/E						R/E
CO4	*						*
CO5	R						R
CO6	R	R					R

Verbs used in Syllabus: Model, Solve, Apply, Understand

NOTES:

- Sections of the syllabus are missing (credit hours)
- Course Outcomes should not be organized using subsections on the syllabus
- Lab section of the syllabus should explain the lab being performed
    - If the lab is team-based, the Course Outcomes should reflect that, therefore they can be mapped to SO5
- CO1, CO2, and CO4 do not use IRE verbs so they cannot be mapped to an IRE level, remove "Demonstrate knowledge of" and replace with IRE verbs - ex:
    - CO1: "Understand basic concepts and definitions of thermodynamics"
    - CO2: "Understand property relationships of pure substances including Ideal Gasses and their applications
    - CO4: "Understand the first and second laws of thermodynamics"
- Remove "Demonstrate the ability to" from CO5 and CO6 - replace with "Apply"
- If the lab components of the course require writing a report, the COs should reflect that

YEAR 3

COURSE NAME: GRE-TOEFL

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R						R
CO3	I/R						I/R
CO4	R						R
CO5	R						R

Verbs used in Syllabus: Use, Calculate, Analyze

NOTES:

- Remove "Demonstrate a mastery of" from CO3 & CO5 - replace with:
  - CO3: "**Understand** concepts of and **calculate** vectors and various vector-related functions"
  - CO5: "**Understand** the basic concepts of and **apply** infinite sequences and series"
- Remove "Demonstrate the ability to" from CO1, CO2, and CO4 - replace with:
  - CO1: "**Use** Mathematica to **calculate** and **create** graphics associated with parameterized curves in the plane and in space"
  - CO2: "**Use** the polar coordinates in the plane"
  - CO4: "**Analyze** parameterized curves and motion in space"

COURSE NAME: Technical Writing

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1			R/E				R/E
CO2			I/R				I/R
CO3							R/E
CO4				R			R/E
CO5			I/R/E				I/R/E
CO6			R/E				R/E
CO7			R/E				R/E

Verbs used in Syllabus: Analyze, Produce, Identify, Practice, Determine, Write, Design, Adapt, Use

NOTES:

- Too many Course Outcomes
  - CO1 could be an assignment or Course Goal instead of a Course Outcome
  - CO3 & CO4 could be combined - "**Determine** and **use** the appropriate research methods for a writing task and **practice** the ethical use of sources and the convention of citations"

COURSE NAME: Aerodynamics

COURSE YEAR/SEMESTER: Year 3, Semester 6

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	I						I
CO3	R						R
CO4	I/R						I/R
CO5	I/R/E		I/R/E				I/R/E
CO6	I						I
CO7	I/R						I/R

Verbs used in Syllabus: Derive, Define, State, Analyze, Use, Compute, Describe, Explain, Calculate

NOTES:

- Sections of the syllabus are missing (credits hours, course ID)
- If there are any projects that are group or team-based, the Course Outcomes need to reflect that with exact verbiage
- CO7 needs to be rewritten to include an IRE verb at the beginning - “Calculate the lift and drag coefficient” or “Solve for the lift and drag coefficient”

COURSE NAME: Heat Transfer

COURSE YEAR/SEMESTER: Year 3, Semester 6

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	R/E						R/E
CO3	R/E						R/E
CO4	R/E						R/E
CO5	R/E						R/E
CO6	R/E						R/E

Verbs used in Syllabus: Understand, Formulate, Solve

NOTES:

- Syllabus is confusing as to what is a Course Outcome and what is a Course Goal - needs to be differentiated

COURSE NAME: Introduction to Aerospace Engineering

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I/R						I/R
CO2	I						I
CO3	I/R						I/R
CO4	I						I
CO5	I						I

Verbs used in Syllabus: Define, Understand, List

NOTES:

- Course Goals and Course Outcomes are essentially the same on the syllabus but need to be different

COURSE NAME: Introduction to Automotive Engineering

COURSE YEAR/SEMESTER: Year 3, Semester -

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	*						*
CO2	*						*
CO3	I						I
CO4	I						I
CO5	I						I
CO6	*						*

Verbs used in Syllabus: Understand

NOTES:

- CO1 & CO2 need to be reworded, they are too long and confusing and also don't use IRE verbs so asterisks are in place of the IRE level where they align with Student Outcomes - replace with:
    - CO1: "**Understand** Automotive engines, their various subcomponents and functions, and the recent developments in the area of internal combustion engines"
    - CO2: "**Understand** automotive transmission concepts and applications (constructional, working principle of various types of manual and automotive transmission), performance characteristics, and the design of the clutch and gearbox for different vehicle applications"
- CO6 needs an IRE verb ("Know" is not one) - replace with "**Understand**"

COURSE NAME: Management for Engineers

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1		I					I
CO2		*					*
CO3		*	*				
CO4				R			
CO5		*					*
CO6		I		I			
CO7	*	*		*			

Verbs used in Syllabus: Understand, Manage

NOTES:

- CO2, CO3, CO5, and CO7 do not have IRE verbs and therefore could not be mapped to an IRE level - need to add these verbs for correct mapping
  - CO2: replace "Learn" with "**Understand**"
  - CO3: replace "Be aware of" with "**Understand**"
  - CO5: replace "Become familiar with" with "**Understand**"
  - CO7: replace "Learn" with "**Understand**"
- Sections of the syllabus are missing (credit hours)

COURSE NAME: Mechanics of Materials

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R						R
CO3	R						R
CO4	R						R
CO5	R						R
CO6	R						R
CO7	R						R

Verbs used in Syllabus: Solve, Analyze, Use

NOTES:

- Too many Course Outcomes - some Course Outcomes can be combined

COURSE NAME: Applied Numerical Methods for Engineers

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	*						*
CO2	R						R
CO3	I						I
CO4	I						I

Verbs used in Syllabus: Demonstrate, Use

NOTES:

- CO1 does not have an IRE verb and therefore cannot be mapped to an IRE level so an asterisk is in place where the CO aligns with an SO, needs an IRE verb added for correct mapping to be done ("**Understand** applied numerical methods for engineers")
- CO3 needs to be reworded - remove "Acquire a good level of understanding of" and replace it with "**Understand**"
- CO4 needs to be reworded - remove "Demonstrate a basic understanding of" and replace it with "**Understand**" or "**Use**"
- If a Course Outcomes includes team-based or group work, the CO needs to reflect it so it can be mapped to SO5

COURSE NAME: Structural Analysis

COURSE YEAR/SEMESTER: Year 3, Semester -

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I/R						I/R
CO2	R						R
CO3	R						R
CO4	E	E					E
CO5	R/E						R/E

Verbs used in Syllabus: Estimate, Analyze, Use, Design, Solve, Validate

NOTES:

- Syllabus overall is very good - would make a good example of what other syllabi should look like
- Remove "Develop the ability to" from CO1 - should read "**Estimate** deflections in structural members **using** energy methods"
- Remove "Ability to" from CO2, CO4, CO5
- Reword CO3 and remove "Develop the knowledge of" - replace with "**Use** the fundamentals of stiffness method to **analyze** trusses and beams"

COURSE NAME: Fluid Mechanics

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I/R						I/R
CO3	I/R		I/R				I/R
CO4	R						R
CO5	R						R
CO6	I/R/E						I/R/E
CO7	R						R
CO8	R						R

Verbs used in Syllabus: Define, Compute, Use, Calculate, Describe, Explain, Apply, Identify, Predict, Solve

NOTES:

- Too many Course Outcomes - can combine CO4 & CO5 "**Apply** continuity, Bernoulli, momentum and energy equations to fluid flow problems and **use** the concept of control volumes to **solve** the fluid flow problems"
- Syllabus overall is very good - would make a good example of what other syllabi should look like

COURSE NAME: Vehicle Aerodynamics

COURSE YEAR/SEMESTER: Year 3, Semester 6

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I/R						I/R
CO2	E						E
CO3	E						E
CO4	E					E	E

Verbs used in Syllabus: Compute, Predict, Incorporate, Perform

NOTES:

- The Grading Breakdown in the syllabus adds up to 150% which is not possible, need to fix that
- CO3 is very vague, need to specifically note what students will be able to incorporate aerodynamics into

---

COURSE NAME: Circuits and Electronics

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	R/E						R/E
CO3	I/R						I/R
CO4	E					E	E
CO5	*		*				*

Verbs used in Syllabus: Determine, Use, Understand, Analyze, Test, Design

NOTES:

- CO5 does not use any IRE verbs and therefore cannot be mapped to an IRE level so asterisks are used in place to show their alignment with Student Outcomes - need to add an IRE verb
- Sections of the syllabus are missing or incomplete (credit hours, catalog description could be improved)

- If teamwork or group-based projects are a part of the course, the Course Outcomes should reflect that so they can be aligned to SO5

COURSE NAME: Structural Analysis

COURSE YEAR/SEMESTER: Year 3, Semester -

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I/R		I/R				I/R
CO3	*					*	*
CO4	R/E						R/E
CO5	*						*
CO6	I						I
CO7	*						*

Verbs used in Syllabus: Understand, Explain, Relate, Understand

NOTES:

- CO3, CO5, and CO7 do not have any IRE verbs and therefore cannot be mapped to an IRE level, need to be rewritten to include an IRE verb to be mapped correctly
  - CO3: “Understand”
  - CO5: “Understand”
  - CO7 - needs to be completely rewritten because it is not coherent
- Course Outcomes are grammatically incorrect and should be fixed
- Sections of the syllabus are missing or incorrect (credit hours, assignments should be listed in the appropriate section)
- If team-based or group projects are a part of the course, the Course Outcomes should reflect that so they can be mapped to SO5
- Syllabus says that some Course Outcomes should be mapped to SO2 & SO4, but this it not shown by the verbs and description of the CO, need to be rewritten to include alignment with these two SOs if syllabus is correct

---

YEAR 4

COURSE NAME: Aerospace Engines Performance

COURSE YEAR/SEMESTER: Year 4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	I		I				I
CO3	R/E						R/E
CO4	R/E		R/E				R/E

Verbs used in Syllabus: Derive, Describe, Solve, Predict, Explain

NOTES:

- Credit hours are missing from the syllabus
- If there are teamwork and group projects in the course, the Course Outcomes should reflect that so the COs can be mapped to SO5
- Some Course Outcomes could be shortened slightly (some specifics could be removed)

COURSE NAME: Embedded Systems

COURSE YEAR/SEMESTER: Year 3, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	*	*					*
CO2	*	*					*

Verbs used in Syllabus: None

NOTES:

- There need to be more Course Outcomes or make the two that are already on the syllabus more specific
- CO1 & CO2 do not use IRE verbs and therefore cannot be mapped to an IRE level, need to add IRE verbs so they are able to be mapped correctly
    - They could also be combined into one Course Outcome - "**Design** and **create** prototypes and projects based on Arduino microcontrollers"
- Syllabus shows that teamwork and group projects are a part of the course, if that is true the Course Outcomes need to reflect that (can add a Course Outcome specifically for group project work) then they can be mapped to SO5

- The Course Outcomes do not show any introduction to Arduino controllers - should add a CO that shows this (ex. "**Understand** the basic functions of an Arduino controller")
- The Course Outcomes need to reflect any lab components of the course

---

COURSE NAME: Failure of Engineering Materials

COURSE YEAR/SEMESTER: Year 4, Semester 8

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I						I
CO3	I						I
CO4	I						I
CO5	I	I					I
CO6	R						R
CO7	E					E	E

Verbs used in Syllabus: Understand, Solve, Join

NOTES:

- Remove "Demonstrate an understanding of" in CO1, CO2, CO3, CO4, and CO5 and replace it with "**Understand**"
- Sections of the syllabus are missing (credit hours, course ID)
- Syllabus says it is a graduate course but it is taken in the 4th year, ensure this is correct
- If teamwork or group projects are a part of the course, the Course Outcomes need to reflect that so they can align with SO5

COURSE NAME: Flight Dynamics

COURSE YEAR/SEMESTER: Year 4, Semester 8

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I						I
CO3	R					R	R
CO4	I/R		I/R		I/R		

Verbs used in Syllabus: Understand, Use, Write

NOTES:

- Sections of the syllabus are missing (credit hours, prerequisites, lab contact hours)
- Remove "students will demonstrate…" from the Course Outcomes to keep them concise and to the point - replace with:
    - CO1: "Understand flight dynamics"
    - CO2: "Understand flight performance, stability and control"
    - CO3: "Use MATLAB as a tool for matrix manipulations and dynamic simulation"
    - CO4: "Work as a team in a project, **summarize** findings in a professional PowerPoint presentation and write a technical document"

COURSE NAME: Introduction to Vibrations

COURSE YEAR/SEMESTER: Year 4, Semester 8

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R						R
CO3	R						R
CO4	I						I
CO5	I						I
CO6	I						I
CO7	I						I
CO8	I/R/E						I/R/E

Verbs used in Syllabus: Derive, Solve, Use, Understand, Predict

NOTES:

- Sections of the syllabus are missing (credit hours, prerequisites)
- Remove "Demonstrate an understanding of" from CO4, CO5, CO6, CO7, and CO8 and replace it with "**Understand**"
- The Catalog Description in the syllabus needs to be a paragraph instead a list of topics
- Too many Course Outcomes - some can be combined into one
    - Ex. CO2 & CO3 - "**Solve** the equations of motion **using** Newton's laws, the conservation of energy, and Lagrange's equations"

COURSE NAME: Machine Design

COURSE YEAR/SEMESTER: Year 4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	*						*
CO2	I						I
CO3	R						R
CO4	I						I
CO5	E						E
CO6	R/E						R/E
CO7	E	E					E
CO8	I/E						I/E
CO9	*						*
CO10							*
CO11	R						R

Verbs used in Syllabus: Understand, Analyze, Design, Select, Use

NOTES:

- The verb in CO8 needs to be clarified, the verbiage is very vague
- Assignments on the syllabus needs to be more detailed
- CO1, CO9, and CO10 do not have IRE verbs and therefore cannot be mapped to an IRE level so asterisks are used in place of the level to show their alignment with SOs
- Remove "Demonstrate an understanding of" from CO2 and replace it with "**Understand**"
- Remove "Develop ability to" in CO5, CO6, CO7, CO8 and replace with:
    - CO5: "**Design** shaft based on allowable stress, deflection, and critical speed"
    - CO6: "**Design** and **analyze** bolted joints"
    - CO7: "**Design** gears according to industrial codes"
    - CO8: "Size and **select** bearings"
- Make CO11 more concise - ex: "**Use** computer aided design software"

COURSE NAME: Mechanical Systems Design

COURSE YEAR/SEMESTER: Year 4, Semester 8

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I/R/E	E					E
CO2	R						R
CO3	R	R					R
CO4	E						E
CO5	R						R
CO6			*				
CO7					R		

Verbs used in Syllabus: Identify, Devise, Apply, Use, Design, Demonstrate

NOTES:

- CO6 does not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, needs to be rewritten to include an IRE verb so it can be mapped correctly, ex:
    - CO6: "**Explain** and **summarize** projects and findings through an oral presentation and a written report"
- Remove "Demonstrate ability to" from CO1, CO3, CO4, CO5, and CO6 - use the IRE verb as the first word of the Outcome

COURSE NAME: Mechanics of Machinery

COURSE YEAR/SEMESTER: Year 4, Semester 8

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	E						E
CO3	E						E
CO4	R						R
CO5	R						R
CO6	*						*
CO7	E						E
CO8	I						I
CO9	I						I
CO10	R						R
CO11	R						R

Verbs used in Syllabus: Analyze, Design, Understand

NOTES:

- CO6 does not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, needs to be rewritten to include an IRE verb so it can be mapped correctly
- Too many Course Outcomes - some can be combined
- Remove “Demonstrate the ability to” from CO1, CO2, CO3, CO4, CO5, CO6, CO7, CO10, CO11, the IRE verb should be the first word so the Outcome is as concise as possible
- Sections of the syllabus are missing (credit hours, prerequisites if applicable)

COURSE NAME: Quality Management

COURSE YEAR/SEMESTER: Year 4, Semester 8

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I	I					I
CO2	I	I					I
CO3	I/R						I/R
CO4	I/R						I/R
CO5	R						R
CO6	*						*
CO7	E						E
CO8	I	I	I				I

Verbs used in Syllabus: Understand, Differentiate, Use, Generate, Write

NOTES:

- CO6 does not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, needs to be rewritten to include an IRE verb so it can be mapped correctly
- Sections of the syllabus are missing (prerequisites if applicable, credit hours, the program it falls under (Aerospace or Automotive))
- Too many Course Outcomes
- If teamwork or group projects are a part of the course the Course Outcomes should reflect that so they can be mapped to SO5

COURSE NAME: Metallurgy

COURSE YEAR/SEMESTER: Year 4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	R/E						R/E
CO3	R/E						R/E
CO4	R/E						R/E
CO5	R/E						R/E
CO6	I						I
CO7	I						I
CO8	I	I					I

Verbs used in Syllabus: Understand, Relate

NOTES:

- Sections of the syllabus are missing (credit hours, course ID, prerequisites if applicable)
- If teamwork or ethical judgment is apparent in the course, the Course Outcomes need to reflect that in their verbiage

COURSE NAME: Combustion Engines

COURSE YEAR/SEMESTER: Year 4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	*						*
CO2	*						*
CO3	*						*
CO4	R/E						R/E
CO5	I						I
CO6	I/R						I/R
CO7	I						I

Verbs used in Syllabus: Apply, Estimate

NOTES:

- CO1, CO2, and CO3 do not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, needs to be rewritten to include an IRE verb so they can be mapped correctly
- Too many Course Outcomes - some can be combined or condensed
- Syllabus lists homework on the grading breakdown, but the assignments section is empty
- If teamwork or group projects are a part of the course, the Course Outcomes need to reflect that in their verbiage
- Remove “Demonstrate knowledge of” from CO1, CO2, CO3, CO4, CO5, and CO7, the Course Outcomes should start with the IRE verb used

COURSE NAME: Energy Systems Design

COURSE YEAR/SEMESTER: Year 4, Semester 8

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R/E						R/E
CO3	R						R
CO4	I/E						I/E
CO5	I						I
CO6	I						I
CO7	R/E					E	R/E

Verbs used in Syllabus: Solve, Interpret, Use, Select, Verify, Understand, Estimate, Formulate

NOTES:

- Course outcomes can be combined or condensed so there are fewer
- If teamwork is included in the course, the Course Outcomes should reflect that in their verbiage
- Remove “Demonstrate the ability to” from every Course Outcome, the IRE verb should be used to start each outcome so they are concise

COURSE NAME: System Dynamics and Control

COURSE YEAR/SEMESTER: Year 4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	*						*
CO2	R/E						R/E
CO3	R						R
CO4	I/R						I/R
CO5	E		*				E

Verbs used in Syllabus: Apply, Simulate, Use, Characterize, Design

NOTES:

- CO1 does not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, needs to be rewritten to include an IRE verb so it can be mapped correctly
- CO5 has an IRE verb that aligns with SO1 and SO7 but there isn't one to align for SO3 but the Course Outcome aligns with that as well, reword to include an IRE verb that algins with SO3
    - Ex. "**Design** a feedback control system that meets desired system output specifications and **explain** work in an oral presentation"
- If teamwork is included in the course, the Course Outcomes should reflect that in their verbiage

COURSE NAME: Thermal Laboratory

COURSE YEAR/SEMESTER: Year 4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	E		I/R			E	E
CO3	R						R
CO4	R		R			R	R
CO5	R						R
CO6	*						*
CO7					*		
CO8			R/E				

Verbs used in Syllabus: Understand, Perform, Write, Analyze, Demonstrate, Prepare

NOTES:

- CO6 and CO7 do not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, need to be rewritten to include an IRE verb so they can be mapped correctly
- Sections of the syllabus are missing or incomplete (credit hours, course description could be improved)
- Syllabus says this course is 100% experimental so there should be more alignment with SO6, Course Outcomes should be reworded to include these lab exercises and experimentation

YEAR 5

COURSE NAME: Computational Fluid Dynamics

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	R						R
CO3	E						E
CO4	R						R

Verbs used in Syllabus: Classify, Apply, Use, Develop, Solve

NOTES:

- Assignments and Lab sections of the syllabus are vague and could be improved
- Syllabus says that teamwork and lab exercises are a part of the course, the Course Outcomes should reflect this
- Reword CO3 so that is more concise and the IRE verb is first - ex. "**Use** CFD to address complex problems to **develop** practical skills"

COURSE NAME: Experimental Methods in Automotive Materials

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	*						*
CO3	I/R/E		I/R/E				I/R/E
CO4	I						I
CO5	I						I
CO6	I						I
CO7	I						I

Verbs used in Syllabus: Identify, Explain, Understand

NOTES:

- Some Course Outcomes can be combined or condensed so there are fewer
- CO2 does not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, need to be rewritten to include an IRE verb so it can be mapped correctly
- Assignments on the syllabus are vague and unclear, should be rewritten so they are more concise and clear
- Remove “The students will be able to” from CO1, CO2, and CO3 so that the IRE verb is first and the outcome is more concise

COURSE NAME: Finite Element Method for Automotive Applications

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I						I
CO3	R						R
CO4	R/E						R/E
CO5	*						*
CO6	R						R
CO7	R						R

Verbs used in Syllabus: Understand, Derive, Formulate, Solve, Use, Simulate

NOTES:

- CO5 does not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, need to be rewritten to include an IRE verb so it can be mapped correctly
- Remove “Be able to” from CO3, CO4, CO5, CO6, and CO7, all should start with the IRE verbs so the Outcomes are concise and to the point
- If ethical or professional responsibility are aspects of the course, the Course Outcomes need to reflect that with their verbiage
- Some Course Outcomes can be combined or condensed so there are fewer

COURSE NAME: Satellites

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I						I
CO3	I						I
CO4	R						R
CO5			I/R		I/R		

Verbs used in Syllabus: Understand, Use, Write, Give

NOTES:

- Remove "Students will demonstrate a good understanding of" from CO1, CO2, and CO3 - start with "**Understand…**" so the outcomes are more concise and to the point
- If ethical judgment is an aspect of the course, the Course Outcomes need to reflect that
- Sections of the syllabus are missing (credit hours, prerequisites)
- Course Goals on the syllabus need to be condensed

COURSE NAME: Aeroacoustics

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	*						
CO2	R						R
CO3	R						R
CO4	R						R
CO5	I						I
CO6	*						*
CO7	R						R
CO8	R						R

Verbs used in Syllabus: Calculate, Derive, Solve, Understand, Use, Predict, Solve

NOTES:

- CO1 and CO6 do not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, need to be rewritten to include an IRE verb so they can be mapped correctly
    - CO1 can be removed or combined with CO2
    - CO6: replace with "**Understand** the difference between sound and pseudo sound"
- Too many Course Outcomes - some can be combined or condensed
- If teamwork is an element of the course, the Course Outcomes should reflect that

COURSE NAME: Flight Control Design

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I						I
CO3	I						I
CO4	R						R
CO5			I		I		

Verbs used in Syllabus: Understand, Use, Give, Write

NOTES:

- Remove "Demonstrate a good understanding of" from CO1, CO2, and CO3 - start with "**Understand…**" so the outcomes are more concise and to the point
- Remove "Demonstrate the ability to" from CO4 & CO5 - start with the IRE verb so outcomes are concise
- If ethical or professional responsibility are an aspect of the course, the Course Outcomes need to reflect that
- CO1, CO2, and CO3 could be condensed into one Course Outcome (ex. "**Understand** flight dynamics, flight stability and control, and controls systems analysis and design techniques")

COURSE NAME: Nondestructive Evaluation NDE

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I		I			I	I
CO3	I					I	I
CO4	R/E						R/E
CO5						E	

Verbs used in Syllabus: Describe, Explain, Select, Apply, Interpret

NOTES:

- Course Outcomes are well written, concise, and align with the proper Student Outcomes
- Sections of the syllabus are missing or need improvement (professor's phone number, catalog description)

COURSE NAME: Propulsion

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I/R						I/R
CO3	I						I
CO4	R/E						R/E
CO5	I/R/E						I/R/E
CO6	I						I
CO7	E						E

Verbs used in Syllabus: Introduce, Understand, Apply, Determine, Analyze, Estimate, Design

NOTES:

- Remove "Develop the ability to" from CO4 and CO7 - start with the IRE verbs so the outcomes are more concise and to the point
    - CO4: "**Determine** and **analyze** the characteristics…"
    - CO7: "**Design** a preliminary propulsive engine"
- Syllabus needs instructor contact information added

COURSE NAME: Turbulent Flows

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	E						E
CO2	R						R
CO3	R						R
CO4							*

Verbs used in Syllabus: Formulate, Solve

NOTES:

- CO4 does not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, need to be rewritten to include an IRE verb so it can be mapped correctly

---

COURSE NAME: Power Electronics for Hybrid Electric Vehicles

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	E						E
CO2	R						R
CO3	I/R						I/R
CO4	*						*

Verbs used in Syllabus: Develop, Acquire

NOTES:

- CO4 does not use IRE verbs therefore it cannot be mapped to an IRE level so an asterisk is in its place to show alignment with Student Outcomes, need to be rewritten to include an IRE verb so it can be mapped correctly
- If teamwork or ethical responsibility are an aspect of the course, the Course Outcomes need to reflect that in their verbiage

---

COURSE NAME: Theory of Continuous Media Applied to Automotive

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	I/R		I/R				I/R
CO3	I						I
CO4	*	*	*	*	*	*	*

Verbs used in Syllabus: Solve, Understand, Analyze

NOTES:

- CO4 needs to be justified as a Course Outcome because it is technically an outcome for the entire program not just a single course - needs to be reworded or removed as a Course Outcome
- Remove “Able to” from CO1, CO2, and CO3 - start with the IRE verb so the outcomes are concise
- Reword CO3 so that it is more concise and clear “**Apply** knowledge from former courses related to fluid mechanics and materials mechanics”
- Sections of the syllabus are missing (course ID, course coordinator, prerequisites if applicable, credit hours)

Computer Science Syllabi Notes

Our team has created a single figure for each course syllabi that was provided to our team by the College of Engineering's Computer Science program. Each figure includes the following:

- Course name
- The year and semester the course is offered
- A correctly mapped Outcome Matrix
- The verbs present within the instructor created course outcomes
- A notes section that describes any additional recommendations our team has for syllabi improvement

Additionally, figures have been arranged by the academic year the student takes the course to aid in report organization and user experience.

Once these recommendations are implemented, the Computer Science program will see noticeable progress toward better alignment of its program syllabi to ABET Accreditation standards.

COURSE NAME: Bases de Données Avancées

COURSE YEAR/SEMESTER: Level -, Semester -

	SO1	SO2	SO3	SO4	SO5	SO6
CO1	R					R
CO2	R/E					R/E
CO3	R/E	R/E				R/E
CO4	R/E		R/E			R/E
CO5			I/R/E			

Verbs used in Syllabus: Apply, Use, Create, Explain

NOTES:

- Sections of the syllabus are missing (course level and semester, prerequisites)
- If teamwork and ethical judgment are an aspect of the course, the Course Outcomes should reflect that so they can be mapped to SO4 & SO5
- Syllabus needs to explain what Continuous Evaluation consists of in the grading breakdown
- There are no projects or assignments listed on the syllabus, add these if applicable

COURSE NAME: Programmation Orientée Objets

COURSE YEAR/SEMESTER: Level A3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6
CO1	*					
CO2	*					
CO3	R	R				R

Verbs used in Syllabus: Use

NOTES:

- Syllabus was in French so Google Translate was necessary to understand the Outcomes
- Remove the word "Master" from each of the Course Outcomes and replace with an IRE verb
    - CO1 and CO2 have no IRE verbs so they cannot be mapped to an IRE level
    - CO3 included the IRE verb "Use" so it can be mapped to the R level
- More Course Goals could be added to the syllabus
- If teamwork is an aspect of the course, the Course Outcomes should reflect that so they can be mapped to SO5
- Syllabus should explain what Continuous Evaluation consists of in the grading breakdown
- There are no projects or assignments listed on the syllabus, add these if applicable

---

COURSE NAME: Distributed Algorithms and Architecture

COURSE YEAR/SEMESTER: Level A4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6
CO1	I					I
CO2	R/E	R/E				R/E
CO3	R/E	R/E				R/E

Verbs used in Syllabus: Understand, Define, Design, Develop

NOTES:

- Syllabus should explain what Continuous Evaluation consists of in the grading breakdown

---

COURSE NAME: IoT and Cloud Computing Applications

COURSE YEAR/SEMESTER: Level A5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6
CO1	I					
CO2	I/R					I/R
CO3	E	E				E

Verbs used in Syllabus: Use

NOTES:

- Syllabus shows Course Outcome alignment with SO2 but the verbiage of the outcomes do not show this alignment, rewrite the outcomes if alignment is present
- Syllabus should explain what Continuous Evaluation consists of in the grading breakdown

---

COURSE NAME: Introduction aux Réseaux Informatique

COURSE YEAR/SEMESTER: Level A-, Semester -

	SO1	SO2	SO3	SO4	SO5	SO6
CO1	I		I			I
CO2	I		I			I
CO3	R/E	R/E				R/E
CO4	R	R				R
CO5	R/E	R/E				R/E

Verbs used in Syllabus: Understand, Describe, Design, Calculate, Apply, Use, Verify, Analyze

NOTES:

- Syllabus shows Course Outcome alignment with SO5 (teamwork) but the verbiage of the outcomes do not show this alignment, rewrite the outcomes if alignment is present
- Sections of the syllabus are missing (contact hours, course number, course level and semester)

COURSE NAME: Calculus I

COURSE YEAR/SEMESTER: Level A1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6
CO1						
CO2						
CO3						
CO4	R					R

Verbs used in Syllabus: Understand, Describe, Design, Calculate, Apply, Use, Verify, Analyze

NOTES:

- CO1-CO3 need to be reworded so they better align with Student Outcomes (they currently don't align to any)
    - Using the IRE verb "apply" they could align with SO1 & SO6
    - Could also be combined into one Course Outcome
- Syllabus shows Course Outcome alignment with SO2 but the verbiage of the outcomes do not show this alignment, rewrite the outcomes if alignment is present

COURSE NAME: Mathematical Programming

COURSE YEAR/SEMESTER: Level A3, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6
CO1	E	E				E
CO2	R/E					R/E
CO3	R/E	R/E				R/E
CO4	R	R				R

Verbs used in Syllabus: Model, Solve, Use

NOTES:

- Syllabus shows CO2 aligns with SO2 but the verbiage of the CO does not show this alignment, need to reword the outcome if alignment is true
- Syllabus should explain what Continuous Evaluation consists of in the grading breakdown
- Contact hours on the syllabus are incorrect

Energy Engineering Syllabi Notes

Our team has created a single figure for each course syllabi that was provided to our team by the College of Engineering's Energy program. Each figure includes the following:

- Course name
- The year and semester the course is offered
- A correctly mapped Outcome Matrix
- The verbs present within the instructor created course outcomes
- A notes section that describes any additional recommendations our team has for syllabi improvement

Additionally, figures have been arranged by the academic year the student takes the course to aid in report organization and user experience.

Once these recommendations are implemented, the Energy program will see noticeable progress toward better alignment of its program syllabi to ABET Accreditation standards.

YEAR 1

COURSE NAME: Automated Combinatorial Systems

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	I/R					I/R	I/R
CO3	I/R					I/R	I/R

Verbs used in Syllabus: Understand, Use

NOTES:

COURSE NAME: PLC and Programmed Logic

COURSE YEAR/SEMESTER: Year 1, Semester 2

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R	R				R	R
CO2	I/R						I/R

Verbs used in Syllabus: Analyze, Study

NOTES:

- List of topics could be improved on syllabus
- Syllabus says that a lab is completed in the course but there isn't one included on the grading breakdown

---

COURSE NAME: Servo Systems and CC Engine

COURSE YEAR/SEMESTER: Year 1, Semester 2

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R					R	R
CO2	R						R
CO3	R					R	R

Verbs used in Syllabus: Analyze, Apply

NOTES:

- Labs are shown as a required part of the course on the syllabus but are not included in the grading breakdown
- The brief list of topics on the syllabus should include more content to give a better overview of the course in its entirety

---

COURSE NAME: Mechanics of Material Point

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R/E						R/E
CO3	R						R
CO4	R						R

Verbs used in Syllabus: Manipulate, Determine, Apply

NOTES:

- If teamwork or group projects are an aspect of the course, the Course Outcomes should reflect that so they can be mapped to SO5
- Syllabus mapping indicates that the Course Outcomes align with SO2, but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment

---

COURSE NAME: Mechanical Engineering

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1							I
CO2							I
CO3	I						I

Verbs used in Syllabus: Recognize, Associate

NOTES:

- If teamwork or group projects are an aspect of the course, the Course Outcomes should reflect that so they can be mapped to SO5
- Syllabus mapping indicates that the Course Outcomes align with SO2, but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment
- The level of Mechanical Engineering needs to be clarified in the Course Name (I, II, III, etc.) because there are multiple “Mechanical Engineering” courses

COURSE NAME: Kinematics of the Solid

COURSE YEAR/SEMESTER: Year 1, Semester 2

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R/E						R/E
CO3	R/E						R/E
CO4	R						R

Verbs used in Syllabus: Calculate, Determine, Apply

NOTES:

- If teamwork or group projects are an aspect of the course, the Course Outcomes should reflect that so they can be mapped to SO5
- Syllabus mapping indicates that the Course Outcomes align with SO2, but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment

COURSE NAME: Mechanical Engineering

COURSE YEAR/SEMESTER: Year 1, Semester 4

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	I/R						I/R
CO3	I/R/E						I/R/E
CO4	R/E						R/E

Verbs used in Syllabus: Recognize, Associate

NOTES:

- Syllabus says this course is taken in Year 1, Semester 4, which is not correct so this needs to be fixed

- Syllabus mapping indicates that the Course Outcomes align with SO2, SO4, and SO5 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment
- In the syllabus, more topics should be added to the topics covered section to give a more holistic view of the course
- The level of Mechanical Engineering needs to be clarified in the Course Name (I, II, III, etc.) because there are multiple "Mechanical Engineering" courses

---

COURSE NAME: Thermodynamics

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1							I
CO2	R						R
CO3	*					*	*

Verbs used in Syllabus: Understand, Apply

NOTES:

- CO3 does not use an IRE verb therefore it cannot be mapped to an IRE level so an asterisk is in place of that to show its alignment with Student Outcomes
    - Needs to be rewritten - ex. "**Develop** and conduct experiments and **analyze** data on heat transfer measurement…"
- Course Outcomes are a bit lengthy, could be shortened by removing some examples and lists of concepts
- Syllabus mapping indicates that the Course Outcomes align with SO6 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment

---

COURSE NAME: Electricity

COURSE YEAR/SEMESTER: Year 1, Semester 1

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1							*
CO2	*						*
CO3	R/E						R/E

Verbs used in Syllabus: Construct, Use

NOTES:

- CO1 and CO2 do not use an IRE verbs therefore they cannot be mapped to an IRE level so an asterisk is in place of that to show their alignment with Student Outcomes
    - CO1 ex. "**Understand** the basic principles that govern electrical circuits"
    - CO2 ex. "**Use** the tools and methods of analyzing electronic circuits…"
- There are many comments and edits proposed on the syllabus, these should be addressed and the syllabus should be reformatted

---

COURSE NAME: Electromagnetism

COURSE YEAR/SEMESTER: Year 1, Semester 2

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	I						I
CO3	*						*

Verbs used in Syllabus: Apply, Understand

NOTES:

- CO3 does not use an IRE verb therefore it cannot be mapped to an IRE level so an asterisk is in place of that to show its alignment with Student Outcomes
    - Needs to be rewritten - ex. "**Understand** the electrical and magnetic phenomena"
- Syllabus mapping indicates that the Course Outcomes align with SO6 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment
- There are many comments and edits proposed on the syllabus, these should be addressed and the syllabus should be reformatted
- Syllabus needs to improve the course description and course goals sections

---

YEAR 2

COURSE NAME: Linear Automatic System

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	R						R
CO3	R/E					R/E	R/E

Verbs used in Syllabus: Identify, Calculate, Model, Use

NOTES:

- Topics covered on the syllabus could be improved and more topics could be added to give a better overview of the course in its entirety
- If CO3 includes a written report, the outcome should reflect that and then it could also be mapped to SO3

COURSE NAME: Kinetics and Dynamics of Solids

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	I						I
CO3	E						E

Verbs used in Syllabus: Determine, Identify, Verify

NOTES:

- Syllabus mapping indicates that the Course Outcomes align with SO4 and SO6 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment
- Clarify what Continuous Evaluation includes on the grading breakdown on the syllabus

---

COURSE NAME: Mechanical Engineering

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I		I				I
CO2							*
CO3	E	E					E
CO4	R/E	R/E					R/E

Verbs used in Syllabus: Describe, Design, Calculate

NOTES:

- CO2 does not use an IRE verb therefore it cannot be mapped to an IRE level so an asterisk is in place of that to show its alignment with Student Outcomes
    - Needs to be rewritten - ex. "**Understand** the terminology and functionality of different assembly parts in a system"
- The level of Mechanical Engineering needs to be clarified in the Course Name (I, II, III, etc.) because there are multiple "Mechanical Engineering" courses
- Syllabus mapping indicates that the Course Outcomes align with SO4 and SO5 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment

---

COURSE NAME: Strength of Materials

COURSE YEAR/SEMESTER: Year 2, Semester 4

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1							I
CO2							*
CO3	R/E						R/E
CO4	E						E

Verbs used in Syllabus: Study, Determine, Verify

NOTES:

- CO2 does not use an IRE verb therefore it cannot be mapped to an IRE level so an asterisk is in place of that to show its alignment with Student Outcomes
    - Needs to be rewritten - ex. "**Understand** the simple mechanical solicitations"
- Syllabus mapping indicates that the Course Outcomes align with SO4 and SO5 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment

---

COURSE NAME: Optics and Propagation of Waves

COURSE YEAR/SEMESTER: Year 2, Semester 3

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I		I				
CO2	I						I
CO3	R						R
CO4	R/E						R/E

Verbs used in Syllabus: Describe. Study, Analyze, Determine

NOTES:

- Syllabus mapping indicates that the Course Outcomes align with SO6 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment
- CO3 & CO4 can be combined to make the Outcomes more concise - ex. "**Determine** and **analyze** the most relevant aspects of waves"
- Syllabus needs to clarify the content in topics to be covered

---

COURSE NAME: Electronics

COURSE YEAR/SEMESTER: Year 2, Semester 4

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	E	E					E
CO3	R					R	R
CO4	R						R

Verbs used in Syllabus: Understand, Design, Analyze, Simulate

NOTES:

- Syllabus mapping indicates that the Course Outcomes align with SO2 & SO6 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment
- Syllabus needs to be more specific in the content covered

YEAR 3

COURSE NAME: Electric and Magnetic Circuit

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	E						E
CO3	I/R/E					I/R/E	I/R/E

Verbs used in Syllabus: Use, Solve, Determine, Estimate

NOTES:

- CO2 contains an IRE verb, but it is not the main point of the Outcome so there should be another verb added to the beginning to make the outcome more concise
    - Ex. "**Determine** the analogy between Electric circuit and magnetic circuit and **determine** hysteresis, saturation…"
- Syllabus shows that the Course Outcomes align with SO2 but the verbiage does not demonstrate this - COs need to be rewritten to show alignment with SO2 if it is present

---

COURSE NAME: Signals and Systems

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	E						E
CO2	E	E					E
CO3	E	E					E

Verbs used in Syllabus: Model, Design, Realize

NOTES:

- CO2 could be made more clear by adding information to describe the filter and also define what "suitable means" (does it need to align with specific standards, etc.)
- Syllabus shows that the Course Outcomes align with SO6 but the verbiage and content does not demonstrate this - COs need to be rewritten to show alignment with SO6 if it is present

---

COURSE NAME: Automation and System Control

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	I						I
CO3	R						R

Verbs used in Syllabus: Model, Use, Study, Calculate, Analyze

NOTES:

- CO2 maps to the I level of IRE due to the verb "Study" but if this topic is being reinforced and emphasized (as other COs in the course are) additional verbs should be added to show that
- Syllabus shows that the Course Outcomes align with SO2 & SO6 but the verbiage does not demonstrate this - COs need to be rewritten to show alignment with SO2 & SO6 if it is present

---

COURSE NAME: Energy Conversion

COURSE YEAR/SEMESTER: Year 3, Semester 6

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	R/E						R/E
CO3	R/E						R/E

Verbs used in Syllabus: Develop, Calculate, Determine

NOTES:

- Syllabus needs to outline what percentage of the course is e-learning
- Syllabus shows that the Course Outcomes align with SO2 & SO6 but the verbiage does not demonstrate this - COs need to be rewritten to show alignment with SO2 & SO6 if it is present

---

COURSE NAME: Discrete Event Systems

COURSE YEAR/SEMESTER: Year 3, Semester 6

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	R/E						R/E
CO3	R/E						R/E

Verbs used in Syllabus: Design, Analyze, Use

NOTES:

- Syllabus needs to outline what percentage of the course is e-learning
- Syllabus shows that the Course Outcomes align with SO2 & SO6 but the verbiage does not demonstrate this - COs need to be rewritten to show alignment with SO2 & SO6 if it is present

---

COURSE NAME: Fundamental Mechanics

COURSE YEAR/SEMESTER: Year 3, Semester 5

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2							*
CO3	R						R
CO4	R						R

Verbs used in Syllabus: Analyze, Use, Solve

NOTES:

- CO2 does not use an IRE verb therefore it cannot be mapped to an IRE level so an asterisk is in place of that to show its alignment with Student Outcomes
    - Needs to be rewritten - ex. "**Understand** new concepts in continuum mechanics…"
- Syllabus mapping indicates that the Course Outcomes align with SO5 and SO6 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment

---

COURSE NAME: Applied Mechanics

COURSE YEAR/SEMESTER: Year 3, Semester 6

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2							*
CO3	R/E						R/E
CO4	R						R

Verbs used in Syllabus: Study, Determine, Solve

NOTES:

- CO2 does not use an IRE verb therefore it cannot be mapped to an IRE level so an asterisk is in place of that to show its alignment with Student Outcomes
    - Needs to be rewritten - ex. "**Understand** the types of vibration of mechanical systems"
- Syllabus mapping indicates that the Course Outcomes align with SO5 and SO6 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment

YEAR 4

COURSE NAME: Digital Signal Processing

COURSE YEAR/SEMESTER: Year 4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R						R
CO2	R/E	R/E					R/E
CO3	E	E					E

Verbs used in Syllabus: Analyze, Design, Calculate, Develop

NOTES:

- Syllabus shows that the Course Outcomes align with SO6 but the verbiage does not demonstrate this - COs need to be rewritten to show alignment with SO6 if it is present

---

COURSE NAME: Power System Analysis

COURSE YEAR/SEMESTER: Year 4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I/R	I/R					I/R
CO2	R/E						R/E
CO3	E						E

Verbs used in Syllabus: Estimate, Analyze, Develop, Solve, Formulate

NOTES:

- Syllabus shows that the Course Outcomes align with SO2 & SO6 but the verbiage does not demonstrate this - COs need to be rewritten to show alignment with SO2 & SO6 if it is present
- CO2 could be split into two separate Course Outcomes so it is not as lengthy
    - CO2: "**Develop** and **solve** the positive, negative, and zero sequence networks for systems consisting of machines, transmission lines and transformers"
    - CO4: "**Solve** for the fault voltages and currents for single line to ground faults, line to line faults, double line to ground faults and three-phase faults"

COURSE NAME: Power System Technology

COURSE YEAR/SEMESTER: Year 4, Semester 7

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I	I					I
CO2	E	E					E
CO3	R/E						R/E

Verbs used in Syllabus: Understand, Design, Determine

NOTES:

- CO2 is not grammatically correct, therefore it should be rewritten so it is easier to understand

---

COURSE NAME: Power Electronics

COURSE YEAR/SEMESTER: Year 4, Semester 8

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	I						I
CO2	R/E	R/E					R/E
CO3	I		I				I

Verbs used in Syllabus: Understand, Design, Analyze, Describe

NOTES:

- Clarify what “CO,” “CF,” and “CC” mean on the syllabus

COURSE NAME: Computational Solid Mechanics

COURSE YEAR/SEMESTER: Year 4, Semester 8

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1							I
CO2	R						R

Verbs used in Syllabus: Study, Solve

NOTES:

- Syllabus mapping indicates that the Course Outcomes align with SO2 and SO4 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment
- If teamwork or group projects are a part of the course, the Course Outcomes should reflect that so they can be mapped to SO5

YEAR 5

COURSE NAME: Fatigue Damage

COURSE YEAR/SEMESTER: Year 5, Semester 9

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
CO1	R/E						R/E
CO2	R						R
CO3							I
CO4	*						*

Verbs used in Syllabus: Predict, Investigate, Understand

NOTES:

- CO4 does not use an IRE verb therefore it cannot be mapped to an IRE level so an asterisk is in place of that to show its alignment with Student Outcomes
    - Needs to be rewritten to make the entire outcome less vague also
- Syllabus mapping indicates that the Course Outcomes align with SO2 but the verbiage of the outcomes do not show this, if they should align, the COs need to be rewritten to include alignment